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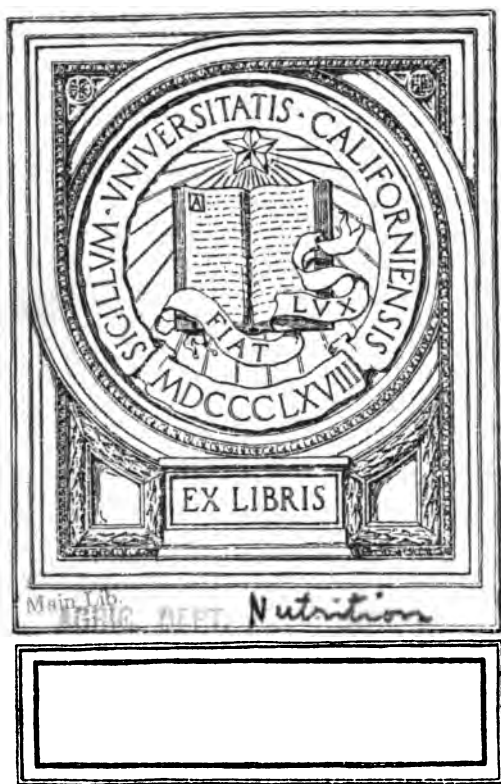
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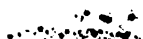
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Practical Flavoring Extract Maker





Practical Flavoring Extract Maker

By

E. J. KESSLER

A TREATISE ON THE MANUFACTURE OF THE PRINCIPAL FLAVORING EXTRACTS, IN ACCORDANCE WITH THE REQUIREMENTS OF THE FOOD LAWS OF THE UNITED STATES; WRITTEN BY A PRACTICAL MANUFACTURER WHO SETS DOWN THE FULL KNOWLEDGE OF HIS SPECIALTY ACQUIRED DURING MANY YEARS OF CONTINUOUS EXPERIENCE.

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Table of Contents

GENERAL OBSERVATIONS	6
QUALIFICATIONS OF A MANUFACTURER	7
WHAT CONSTITUTES A FLAVORING EXTRACT	8
MANUFACTURE OF VANILLA EXTRACTS	
Description of Varieties of Vanilla Beans— Resins—Selecting Beans—Bean Storage—Cut- ting Beans—Exhaustion of the Vanilla Bean— Tonka Extract—Imitation Vanilla Extracts— Non-Alcoholic Extracts—Testing Vanilla Extracts	10-31
MANUFACTURE OF LEMON EXTRACTS	
Terpeneless Extract of Lemon—Lemon Flavor, Imitation—Extract of Orange	32-41
VARIOUS EXTRACTS	
Extracts of Almond, Wintergreen, Pepper- mint, Ginger, Rose, Allspice (Pimento), Anise, Celery, Cinnamon, Cassia, Cloves, Mint (Spearment), Chocolate, Sarsaparilla (imitation), Pistachio (imitation)—Ethereal imitation Flavors	42-51
LABORATORY NOTES	
Menstruums (solvents)—Rules for Testing Alcohol, Oils, etc.—Filtration—Double Pres- sure Filter and Percolator—Testing Methods— Estimation of Small Quantities of Essential Oils—To Determine per cent. of gas in Aqua- Ammonia, and per cent. of Acidity of Vinegar —To Purify Essential Oils	52-66
MISCELLANEOUS RECEIPTS	67-69
ADHESIVES	70
WEIGHTS AND MEASURES, TABLES	71
HOUSEHOLD AMMONIA	72
BOTTLES AND CORKS	73-76
FIGURING COSTS	76-79
INDEX	80-83

General Observations

PRIOR to the enactment of the State and Federal pure food laws, few classes of food products were so grossly adulterated as flavoring extracts. Some of the compounds termed "extract of vanilla" were manufactured at a cost of from 40 to 60 cents per gallon. This condition undoubtedly resulted from the ease with which substitutes that readily deceive the purchaser are prepared. The average manufacturer was by no means inspired by the desire to adulterate; in the majority of instances the causes of the decline in the quality of the extracts offered can be traced directly to the door of either the dealer or consumer, or both. In justice to the manufacturer, it may be stated that the rule of price regulating quality was generally observed. This rule, although holding good in the main, has its exceptions. The discussion, while not having a direct bearing on the manufacture of flavoring extracts, is of sufficient importance, especially when the manufacturer is called upon to match goods offered by competitors; and in order to properly decide such problems, he should have a fair knowledge of the non-technical processes for conducting tests.

QUALIFICATIONS OF A MANUFACTURER.

The primary qualifications of an extract manufacturer are embraced in an ordinary education, plus a liberal display of effort. One need not be a graduate chemist, although a knowledge of the fundamental principles of chemistry will prove a valuable aid. For the beginner, in the absence of a better opportunity, the writer will suggest that he study a chemical text book such as "Steele's Popular Chemistry." Too much importance cannot be attached to the necessity of familiarizing one's self with both the Federal and State food laws, and the author would suggest that one request from the Secretary of the United States Department of Agriculture the mailing to him of all printed matter having reference to the Federal Food Law requirements, including circular No. 19, "Standards of Purity for Food Products," and also to place his firm name on the mailing list for "Notices of Judgment," the latest rulings, etc., and adhere to the Department's teachings religiously. The same course should be followed in respect to the State or States in which one's products are offered for sale. In the event of his inability to interpret the laws, it will be best to employ the services of a competent attorney.

One should never entertain the idea that his particular process or system is perfect and he should not forget that perfection is an impossibility and that true progress is from the less to the greater. It requires energy and push to make headway in the world, and since work is ordinarily the measure of success, an active, energetic and persevering man is sure to succeed.

WHAT CONSTITUTES A FLAVORING EXTRACT?

The best definition is contained in Circular No. 19, of the United States Department of Agriculture, as follows:

"A flavoring extract is a solution in ethly alcohol of proper strength of the sapid and odorous principles derived from an aromatic plant, or parts of the plant, with or without its coloring matter, and conforms in name to the plant used in its preparation."

This definition excludes all preparations which are not solutions in alcohol and eliminates the various forms of flavored sugars which are quite extensively used abroad.

Extracts are divided into four classes, as follows:

1. Those obtained by maceration and percolation of beans, seeds, roots, leaves and fruit of the plants.
2. Those obtained by soltuion of essential oils.
3. Those obtained by solution of synthetics (imitations), such as vanillin, and coumerin tinctures.
4. Those obtained by solution of compound esters (a compound ether derived from an oxygenated acid).

First Class. The following extracts are included under the first class: Vanilla, Tonka, Ginger, Celery, etc.

Second Class. Lemon extract; Terpeneless lemon extract; Orange extract; Terpeneless orange extract; Cinnamon extract; Cassia extract; Almond extract; Peppermint extract; Wintergreen extract; Nutmeg extract; Rose extract; Anise extract; Celery extract; and Thyme extract.

Third Class. Under the third class are included extracts as follows: Vanillin extract, the synthetic principle of the vanilla bean; coumarin extract, the synthetic principle of the tonka bean; imitation wintergreen ex-

tract, methyl salicylate, the synthetic principle of oil of wintergreen; imitation almond, benzaldehyde, the synthetic principle of oil of bitter almonds; imitation sassafras, safrol, the synthetic principle of oil of sassafras.

Fourth Class. Under this class are included extracts as follows: Imitation pineapple, strawberry, banana, raspberry, apple, cherry and peach—all ethereal products representing ethyl butyrate, amyl butyrate, ethyl formate, amyl acetate, ethyl acetate, and amyl valerate, all blended in proportions to represent the various flavors desired.

VANILLA EXTRACTS

VANILLA BEANS.

The vanilla bean, being the source of the most important and popular flavoring on the market, will first be considered. The bean-producing plant is a climbing parasite (the *Vanilla planifolia* of Andrews). It was first described by a Franciscan Friar in 1575, and at that time was supposed to be of great medicinal value. The bean is a native of Mexico, the West Indies, South America, the Bourbon Isles (chiefly the Comores group), Réunion, Seychelle, Madagascar, and the East Indies.

Vanilla beans on the market are of various kinds as to name and quality. We have the Mexican, Bourbon, imitation Mexican, Tahiti, Guatemala, Java, and Vanillon or Wild Vanilla. In quality we find quoted: ordinary; fair; good; extra; split; cuts; broken lots of mixed lengths; and powdered with 50 per cent. of sugar. Thus we have various grades, from which no one can fail to find his liking, either in price or quality. In England manufacturers use the Bourbon Beans almost exclusively, using the Seychelle variety, Seychelle being an English province. France naturally is very partial to the Bourbons and Mexicans, while Germany is very partial to the Tahiti. The Germans do not make extract, but sell vanilla beans by the piece, these pieces being boiled with the pudding, etc.; the consequence is that the Germans want as many beans as possible for the price per pound, and they naturally purchase the Tahiti grade.

The United States, among the nations, is by far the

largest consumer of vanilla beans, the two most popular grades being the Mexicans and Bourbons, although of late the Tahiti is being more extensively used in various blends.

DESCRIPTION OF VARIETIES OF VANILLA BEANS.

The first quality of *Mexican* beans occurs in pods of from 8 to 10 inches long, flattened, $\frac{1}{4}$ to $\frac{3}{8}$ inches in diameter, with the lower end slightly tapered, the upper end gradually tapering for about a quarter the length of the pod, and is usually curved and slightly twisted near the point. The color is dark brown, the pods plump, the surface rigid longitudinally and frequently containing an incrustation of fine crystals beginning at the ends, gradually extending; when fresh, somewhat viscid, but always roughish to the touch.

The *Bourbon* vanilla resembles the Mexican, but is scarcely so long in the tapering portions; is of a dark brown, almost black color; is not as firm as the Mexican; has a smooth and waxy surface and frequently becomes covered with a coating of needle-shaped crystals (vanillin) known as "frost."

The *Seychelles* and *Mauritius* vanilla has the pods 6 inches in length, not over $\frac{1}{4}$ inch in width, and is characterized by the pale color, the faint odor and a smooth but not waxy surface.

Guadeloupe vanilla is usually recognizable, when the bean is entire, by it being broad and flattened, usually $\frac{1}{2}$ inch or more wide, slightly tapering at the lower end and, at the upper, sharply tapering an inch or so at the point. It has a reddish brown color and possesses an

inferior pungent odor. It is very pulpy, with a surface intermediate between the Bourbon and the Mexican, and has but few crystals. One variety of this vanilla, sold under the name of "Vanillons," possesses the odor of heliotrope and is used principally by perfumers and tobacco manufacturers.

Java vanilla, which is almost exclusively consumed in Holland, has a pod from 4 to 6 inches long, and has a flavor almost as fine as that of the Mexican bean and a much stronger odor.

Tahiti vanilla (transplanted Mexicans) has its pods from 4 to 7 inches long, is flat, from $\frac{3}{8}$ to $\frac{1}{2}$ inch wide, and has a slightly reddish brown color. Owing to the insufficient attention of the vanilla planters (mostly Chinese) of the Society Islands (Tahiti being the shipping port) to the curing of the beans and the indiscriminate sale of their entire crop without regard to maturity, the value of the Tahitian vanilla has been depreciating in the world's markets; however, since the vanilla laws, which went into effect April 1, 1911, providing means for licensing the curers and a rigid inspection of the beans prior to shipment, the character of this grade of vanilla has been very materially improved and is being extensively employed in this country. Nearly all of the *Tahiti* vanilla is received at the port of San Francisco, Cal.

An interesting incident in the growth of vanilla beans is the artificial pollenization of the flower. Originally the cultivators depended solely upon insects to transmit the pollen from blossom to blossom, the results being anything but satisfactory, since some of the vines were made to bear too many pods, while others too few, resulting in a loss in both quality and quantity of the fruit produced.

To overcome this difficulty the planter pollinizes by hand, the operation being a simple one and accomplished by removing the pollen from the male flowers by means of a splinter of wood, about the size of a tooth pick, and placing small portions of the pollen in the female flowers. Since the flowers open during the night and close before midday, the work is performed in the early morning and is most successful if performed on the first day on which the flower blossoms. Flowers not successfully pollinated soon wither and fall. With this method the number of pods which each vine is maturing can be ascertained and controlled, according to its age and physical structure.

The fruit, as first picked, has no aroma, the vanillin during the process of curing being developed from the glucoside conferin in the interior of the fruit. When vanilla beans are left to ripen too long, the pods will split and deteriorate, and the beans are then either sold as "splits" or are mixed with other inferior goods and sold as "cuts." The sale of cuts permits of considerable sophistication, in that, frequently, such beans as Tahiti are found among the mixture. Beans that have been picked too early are likewise distinctly inferior.

If vanilla beans, finely divided, be distilled with water, a turbid liquid passes, which becomes clear by agitation with sulphuric ether, which ether on evaporation yields crystals of vanillin.

Vanilla beans, from which the vanillin has been removed by means of a solvent, are sometimes offered to the trade. The fraud is to be detected by the absence of the flavor and odor. Such beans, also beans of an inferior quality, are sometimes "improved" in appearance and in odor by the use of benzoic acid.

For the detection of this fraud, the operator should

avail himself of the fact that while benzoic acid crystals are flattened and rhomboidal and generally lie upon the bean, those of vanillin are usually needle-shaped and stand out almost at right angles from the surface of the fruit. These indications are not always infallible, since the crystalline structure is influenced considerably by the temperature, humidity of the surrounding air, etc. To more accurately determine the character of the flat crystals, detach them with the aid of a knife point, place in a test tube, heat over a Bunsen burner, and, if composed of benzoic acid, the unmistakable irritating odor of benzoic acid may be detected.

The absence of the crystalline coating on the vanilla beans is not necessarily an indication of inferiority, since high grade vanilla beans very frequently manifest an opposite condition. The most important fragrant principle of the vanilla bean and true vanilla extract is vanillin (*Methyprotocatechuic aldehyde*), a crystalline compound, the beans containing from 1 to about $2\frac{3}{4}$ per cent. The practical value of a vanilla bean is not, by any means, to be determined by the per cent. of vanillin content, since it frequently occurs that the very finest beans will show the smallest vanillin content. Busse found the following percentages of vanillin:

Mexican vanilla beans.....	1.69 to 1.86
Bourbon vanilla beans.....	1.91 to 2.48
Tahiti vanilla beans.....	2.00
German African vanilla beans...	2.16
Java vanilla beans.....	2.75

RESINS.

While vanillin is a most important constituent of vanilla beans, there are other substances, such as resins,

gums, etc., soluble in dilute alcohol, that contribute to the fragrance and value of the extract. It is from these resins and gums that the vanilla extract derives the greater portion of the dark brown color. Practically nothing at this time is known of the chemical constituents of vanilla resins. Experience has amply proven that to extract these resins thoroughly, a menstruum of at least 50 per cent. by volume of alcohol is necessary.

Vanilla resins are a valuable analytical index, demonstrating approximately if the correct portion of beans to menstruum has been employed, likewise if the latter was of sufficient strength and if the extracting process was thorough.

According to Brooks, the amount of resin present in different beans is as follows:

	Per Cent.
Mexican (whole)	1.47
Mexican (cuts)	1.96
Seychelle (Bourbon cured).....	1.93
Comoros (Nossi Bey).....	1.96
Comoros (short)	1.90
Mexican and South American, equal parts.	2.56

SELECTING BEANS.

In purchasing vanilla beans it is almost a necessity to take them on trust as to quality. The question of length as an element of value appears now to be ignored by some of the larger buyers, on the principle that the mere length of the bean has no more to do with its flavor or flavoring qualities than the length or breadth of a man decides his mental or moral qualities; but as station, culture and education all play their part in the formation of character, so soil, climate and cultivation estab-

lish the quality of the fruit under consideration. To be candid, and speaking as a manufacturer, we need more knowledge on the relative value of this valuable fruit, since all that the average buyers are sure of in purchasing are the price, aroma and physical structure; therefore, in buying vanilla beans one should try to deal with the most reliable concern of whom he has knowledge.

The most practical method to pursue in purchasing beans would be as follows: When in the market for beans, request from your dealer or dealers quotations with samples, and on receipt of samples proceed to make up test batches with the aid of small test percolators, or by maceration with frequent agitation, being careful to employ the same relative quantity of beans and menstruum strength and treatment in all tests under operation. A test of this character can be successfully conducted within a period of forty-eight hours. When completed, first carefully note the density of color; next dealcoholize in a porcelain evaporating dish over a water bath; remove, and when almost cool, determine character of aroma by the sense of smell, and when thoroughly cool, by the sense of taste. In this manner you will be in a position to determine the relative values of the samples submitted.

BEAN STORAGE.

Beans that are not required for immediate use should be stored in a cool, dry store room and should be examined from time to time to guard against the formation of mold or other infection. Beans can be successfully stored in their reduced (cut) state, provided they are incorporated with sufficient dilute alcohol (equal parts) or glycerin to cover them, and kept in an air-

tight container in a cool place; but do not forget to note on the package the exact weight of the beans, also the amount of dilute alcohol or glycerin used, as then you will be enabled to determine your formula more correctly.

CUTTING BEANS.

Vanilla beans should always be cut, not ground, for the following reasons: Grinding, in every instance, is accompanied with a rise of temperature, and it is a proven fact that the heating of vanilla beans results in the decomposition of the greater portion of the highly flavored aldehydes. The several forms of "meat cutters" that are sometimes used rip and shred the beans, and, through friction, generate considerable heat, always at the expense of the loss of some of the active principles; whereas, with the use of a suitable knife chopper, the beans can be and should be reduced to a fine powder—the finer the better the extraction, minus the heat. Too much importance cannot be attached to this branch of the subject. There are on the market a number of machines adapted for this purpose, and they can be had in either hand or belted power drives from \$12.00 (the American chopper, hotel size) upward.

EXHAUSTION OF THE VANILLA BEAN.

EXTRACTION.

The process for the rapid and thorough exhaustion of the vanilla bean constitutes the principal feature in the successful operation on this popular and costly fruit, since the vanilla bean is generally conceded as ranking among the most difficult substances from which to extract its soluble or active principles, especially by percolation alone. The formula to be followed or the partic-

ular process to be adopted does not appear to be of such importance as that the complete exhaustion of the bean be secured, the work be well done, whether by percolation, maceration, digestion or a combination of the three.

The proper menstruum, of course, will be the one that intelligent experiment has amply demonstrated as the most perfect in exhausting and preserving the important principles. Vanilla extract differs from most of the other important extracts in its source, being made direct from the aromatic substance in its crude or natural condition; also in that it does not depend on a volatile oil for its virtue.

PERCOLATION.

Percolation is the process whereby a finely divided fruit or drug is deprived of its soluble constituents by the descent of a liquid (menstruum) through it, the operation also embracing the process of straining and filtration. Percolation is admirably adapted to a large number



of drugs, but is not suitable in the manufacture of vanilla extract, for the following reasons: Slow operation, which must not exceed fifty drops per minute; excessive losses in alcoholic evaporation, ranging from 10 to 15 per cent.; incomplete exhaustion of the beans, since any irregular particles will tend to form an heterogeneous mass, offering a higher resistance to the flow of the menstruum than the coarser particles; and the beans, being of a semi-soft character, when placed in the percolator, have the tendency of conforming into packed masses of unequal resistances, resulting in the flow following the course of least resistance, with the consequent losses from incomplete exhaustion. See Fig. on opposite page (glass percolator.)

MACERATION.

The process of maceration consists of exposing the finely reduced beans in the menstruum until they are thoroughly penetrated and the soluble or active principles are dissolved. The usual method is to introduce the beans into an air-tight container; agitate frequently during four to six months, decant the clear liquid; express the residue; filter and mix the liquids.

According to Remington's practice of pharmacy, "maceration is the process directed by the German Pharmacopœia exclusively in preparing tinctures," and under the heading of percolation, he adds: "In Great Britain, France and Germany the process (percolation) is well known and is practiced to some extent, but maceration still holds in these countries the chief place as a means of extracting the soluble principles of drugs"; further, "No attempt should ever be made to produce fluid extracts on the small scale without previous maceration," and "the intelligent practice of the process of percola-

tion, therefore, requires an accurate knowledge of the constituents and physical properties of medicinal substances."

DIGESTION.

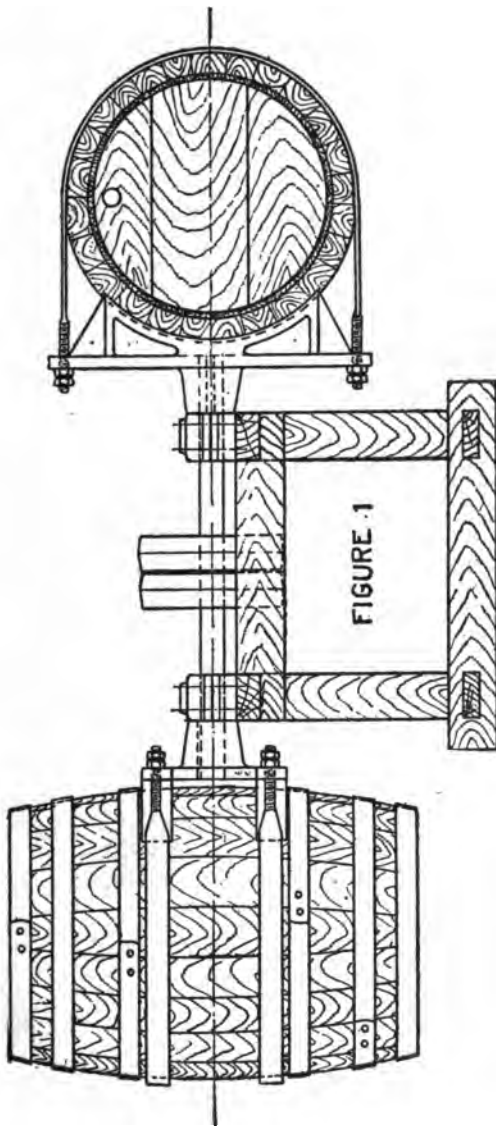
The use of heat for extraction is an old and discredited method and should never be practiced, since the effect of heat on the beans has the tendency of decomposing the highly flavored aldehydes, with consequent loss of character.

Exhausting the beans in vacuo would prove practical were it not for the fact that a large portion of the vanillin ethers and esters are carried over into the pump, which, of course, represents an irreparable loss.

The most rapid, economical and thorough process for exhausting the active principles of the vanilla bean consists of mechanical maceration, the beans and menstruum being placed in a suitable machine designed for the purpose (see figure on page 21). This machine is fitted with an air-tight cover for receiving and discharging the content, and is absolutely air-tight, thoroughly eliminating all possibility of alcoholic evaporation. The effect of the violent, protracted surge of the menstruum in the machine is to force it through the cellular structure of the beans many thousand times during each day's operation, resulting in a rapid and thorough exhaustion by the combined mechanical and solvent power of the menstruum, with the certainty that all of the available vanillin, resins and color content of the beans are in solution; whereas, in percolation, the menstruum comes in contact with the beans but once.

PERCOLATING PROCESS.

Select a percolator (conical preferred) with a capa-



MECHANICAL MACERATOR

city double the amount required to hold the beans, and place at the bottom a small quantity of washed excelsior; then place a layer of beans (cut fine) about three inches deep, then another layer of excelsior, then another of vanilla, until you have the entire quantity of the beans in the percolator. The beans should be packed, using a packing stick for the operation. Considerable care and experience are required so that the packing will be as uniform as possible throughout the entire mass. Also guard against packing too tight, since in that event the menstruum will refuse to flow; on the other hand, unless sufficient resistance is offered to the menstruum, the net results will be far from satisfactory.

Now add the menstruum, slowly, until the beans are covered; open the spigot, and, when the percolate appears, close the spigot, and, after covering the percolator, allow it to stand twenty-four hours to macerate; then open the spigot and permit the percolate to proceed, adding the menstruum until completed, which should be in from four to five days.

Place the dregs into a cotton bag, put into a powerful screw press and express, filter and add to the percolate; next add the sugar, completing the operation. The dregs should be saved for making a second quality of extract, but the resultant liquid would not pass as a legal vanilla and would have to be labeled "imitation."

MECHANICAL MACERATION-PROCESS.

Place the menstruum into the container of the machine; next, add the finely cut (not ground) beans, screw down the air-tight cover and start the machine. From two to three days are sufficient to complete the exhaustion, since the beans and menstruum are brought into a surging contact, 26,000 times per day.

The entire mass can now be transferred to a percolator for clarifying, although the use of the double pressure filter and percolator, described on page 21, will be found the most rapid and satisfactory. After the extract has ceased to flow from the dregs, ascertain the amount necessary for completing the volume of finished product and add that amount of water in the filter (water displacement); pour the water very carefully, letting it fall on a glass plate so that the position of the beans may not be disturbed. If you use sugar in your vanilla, do not fail to allow for the volume increase (see sugar table page 71). Always add the sugar to the finished product.

We will suppose that the batch completed represented 25 gallons, and that the menstruum used is what is known as dilute alcohol, viz., equal parts by volume; next add sufficient water in the filter until $12\frac{1}{2}$ gallons of water washings has been obtained. The use of this water will be found under the heading of menstruum (solvent).

FORMULA.

The Federal "Standards of Purity for Food Products" defines vanilla extract as follows:

Vanilla extract is the flavoring extract prepared from vanilla bean, with or without sugar or glycerin, and contains in one hundred (100) cubic centimeters the soluble matters from not less than ten (10) grams of the vanilla bean."

"Vanilla bean is the dried, cured fruit of *Vanilla planifolia*, Andrews."

The foot-note on page 13 of Circular No. 19, issued by the Department of Agriculture, contains the following:

"The flavoring extracts herein described are intended solely for food purposes and are not

to be confounded with similar preparations described in the Pharmacopœia for medicinal purposes."

Since 10 per cent., or 12 $\frac{4}{5}$ ounces, of beans to the gallon is the minimum allowed by law, the necessity of extracting all of the soluble principles is at once apparent. However, as a matter of precaution, it is much more advisable to employ 13 or 14 ounces to the gallon, as per the following formula:

Vanilla beans, cut very fine.... 14 ounces
Cologne spirits (190 proof).... $\frac{1}{2}$ gallon
Pure water $\frac{1}{2}$ gallon
Cane sugar to suit (5 to 10 per cent.).
(Sugar vs. Glycerin.)

The philosophy of adding glycerin to vanilla was based on the theory that glycerin acts as a binder during baking operations. While it is true that vanillin is soluble in glycerin, and glycerin is a non-volatile or fixed body, various baking tests failed to substantiate the theory. The use of glycerin has many supporters, while others, including such eminent authorities as Dr. C. P. Nicholls ("Monograph on Flavoring Extracts," by Harrop), writes as follows: "A mixture of cologne spirits, water and glycerin has been tried, but I have not found the addition of glycerin an improvement."

The use of sugar is to be recommended, since it will increase the body and help to bring out the flavor.

AGEING.

The principal virtue in storing vanilla in wood for a long period consists of dealcoholization. This can be demonstrated by dealcoholizing a sample in an evaporating dish at room temperature, and comparing with sample

not so treated. Ageing practically amounts to concentrating, since alcohol is not an active principle, and although at least 50 per cent. by volume of alcohol is necessary to extract the vanillin, resins and other active principles after once being dissolved, they will remain in solution even when the alcoholic content of the extract has been reduced 15 per cent.

The lowering of the alcoholic strength by the direct addition of water will precipitate the greater portion of the resins, and resins once thrown out of solution in this manner do not dissolve again by simply adding a little more alcohol.

TONKA EXTRACT.

"Tonka extract is the flavoring extract prepared from tonka bean, with or without sugar or glycerin, and contains not less than one-tenth (0.1) per cent. by weight of coumarin extracted from the tonka bean, together with a corresponding proportion of the other soluble matters thereof."

The tonka bean is the odoriferous seed of Wildingham (*Dipteryx odorata*), a large tree growing in Guiana. Two varieties commonly found in the market are Angostura and Para, the former being held at a much higher price than the latter. Another kind, Surinam, is also known to the trade.

The active or odorous principle of the tonka bean consists chiefly of coumarin, a rhomboidal, somewhat irregular crystalline compound ($C_9H_8O_2$), the anhydride of coumaric acid. It is prepared synthetically from sweet clover, melilot, and other plants. The tonka bean has a strong, agreeable, rather heavy, aromatic odor which, while not resembling the vanilla in flavor, is sometimes

used to "strengthen" vanilla, the proportion in which it may be mixed with vanilla being a matter of taste and cost.

IMITATION VANILLA.

The principal ingredients employed in the manufacture of imitation vanilla are synthetic vanillin and coumarin. The characteristic features of coumarin is described under heading of "Tonka Extract." Synthetic vanillin is obtained from eugenol, the heavy oil of clove. The natural vanillin and the synthetic vanillin are chemically identical, but in the flavoring there is a perceptible difference in favor of the natural. However, it is rather difficult to explain how and where the difference exists. Vanillin alone is too delicate for general results, and a slight proportion of coumarin is necessary to bring out its qualities, as per the following formula :

Vanillin	7 ounces
Coumarin	1 ounce
Cane sugar	8 pounds
Spirits	3 gallons
Pure water to make.....	10 gallons
Caramel color to suit.	

Dissolve the vanillin and coumarin in the alcohol; next dissolve the sugar in the water and mix; filter, if necessary.

A proportion of one part coumarin to four parts vanillin may perhaps please some customers, particularly for culinary purposes. A product of this character will be found much stronger and considerably cheaper, but of course it lacks the delicate character :

Vanillin	4 ounces
Coumarin	1 ounce
Cane sugar	6 pounds

Spirits $\frac{1}{2}$ gallon
 Pure water to make..... 7 gallons
 Caramel color to suit.

Proceed as in first formula.

WHITE VANILLA.

There will be found an occasional demand for a "white vanilla." All that is necessary is to eliminate the color from the foregoing formulas. The only advantage it possesses is the absence of any tint when used in white work such as frostings, etc. It should be protected from strong light owing to its tendency to discolor.

USES HOT AND COLD.

Tests on syrups, cold custards, ice cream, cake and candy have amply demonstrated the relative value of true and synthetic flavors for usage in hot or cold work. On all cold work, the true flavor showed a distinct advantage, while on hot work the synthetic proved the more lasting and valuable. This rule holds good with all flavors; the vanilla lost most of its highly flavored esters by the action of heat, while vanillin seemed to hold its full power.

NON-ALCOHOLIC EXTRACTS.

Non-alcoholic flavors are prepared in two forms, viz. : Powder and paste. In the powder form the composition is usually the essential oil incorporated with cane sugar and glycerine in about the following proportions:

Granulated cane sugar..... 65 pounds
 Oil of bitter almonds..... 3 pounds
 Glycerin, C. P..... 2 pounds

The ingredients are thoroughly mixed and packed in paper-lined air-tight tin containers.

In the paste form, the composition and proportions are about as follows:

Vanillin 2 ounces
Coumarin $\frac{1}{2}$ ounce
Glycerin, a sufficient quantity.
Caramel color, a sufficient quantity.

Glucose, quantity sufficient to make 14 pints.

The vanillin and coumarin are thoroughly mixed with a sufficient quantity of glycerin until a smooth paste results, then add the glucose, thoroughly mix, and lastly add the caramel color to the desired shade. These goods are packed in one and two-ounce collapsible tubes.

The legal requirements having reference to the proper labeling of these preparations should be very carefully investigated before attempting to place them on the market, since they are not entitled to the term "flavoring extracts," the Department of Agriculture specifying an extract as a solution in ethyl alcohol.

MENSTRUUM.

The subject, alcohol content of menstruums, is of vital interest for the following reasons:

First—Since alcohol does not contribute to the flavoring value of any extract, being entirely dissipated when used in baking, the per cent. necessary is the amount that will thoroughly extract the available active principles and preserve them at the lowest temperature to which the extracts will be exposed after shipping; hence any surplus quantity employed will represent an actual waste.

Second—Vanilla being regarded as one of the most delicate flavors known, it is always desirable to put the finished product on the market with the lowest per cent. of alcohol possible, conditional that all of the available vanillin and resins have been extracted and held in solution. The minimum per cent. is thirty, since in the event

of the alcohol falling below this number, the Government chemists invariably go further and test for total solids.

Third—No manufacturer would knowingly add an unnecessary cost to any of his products.

The most intelligent method for determining the per cent. of alcohol necessary is to prepare small test batches, using, as a minimum, 45 and proceeding up to 55 per cent. by volume. Fifty per cent. as a rule is ample with the average beans, and occasionally we find old crop dry Mexicans that will operate nicely on 45 and 40 per cent. The principal trouble to guard against is the question of clarification, due to the fact that all vanilla beans contain a mucilaginous (gummy) product. As this matter is insoluble in strong alcohol, it is necessary to employ sufficient alcohol to keep the gummy matter out of solution. To overcome the necessity of employing a high per cent. of alcohol (above 50 by volume), several processes have been tried out with more or less success.

First—By the removal of the mucilaginous principle with the use of boiling water. While this method certainly does remove the gum, it also has the effect of decomposing some of the more volatile aldehydes and esters; there is also the loss by vaporizing of some of the vanillin. If the water used for this purpose was not used in the making up of the menstruum, there would be quite a loss of vanillin, since this product is soluble in hot water.

Second—By drying the beans after cutting, the beans being spread out in a thin layer and exposed to a temperature of not more than 110 degrees F. The process, if properly conducted, will harden the gum and in consequence permit the use of a weaker menstruum. It must not be forgotten that the effect of the heat on the beans has the tendency of vaporizing some of the more volatile

constituents of the bean, with the consequent deterioration of the finished product.

Third—By the use of a strong primary menstruum, as follows:

Vanilla beans, finely cut.....	1 pound
Cane sugar	1 pound
Alcohol, 190 proof.....	5 pints
Pure water	3 pints

The alcohol and water *must* be mixed previous to pouring on the beans, this rule holding good in any process followed.

The above produces an extract in the proportion of one part of beans to eight parts of extract. By adding two pints of water to each eight pints of finished extract, you produce an extract in the proportion of one to ten, conforming with the National Food Laws, as well as all the State laws. The extra water is added after removing the extract from the beans and after the extract has stood a few days.

There is one serious objection to this process in that it is impossible to add water to a finished extract without throwing out of solution a perceptible amount of the resin content; and since it is these resins that serve as an index to the analytical chemist in determining whether 10 per cent. of beans was used, the process is not recommended.

Fourth—By the use of “water-washings” described under “Mechanical Maceration.” The process produces the best results of all methods heretofore described and operates under the following principle: When the exhausted beans are treated with water, the resultant product is known as water-washings; and since these gums are insoluble in alcohol and are freely soluble in water, the water-washings contain a very appreciable amount

of the gum in solution ; and when about an equal amount of alcohol is added, the mucilage is thrown out of solution (precipitation) and gradually settles to the bottom. In practice, the beans are placed in the container and the alcohol and water washings are mixed and added to the beans in the least possible time required. If, under ordinary conditions, the gum is dissolved with the use of the water-washings, the gum from the beans would unite with the gum thrown out of solution from the washings and both would settle to the bottom at one and the same time. This operation requires the least time and labor, while no loss of any of the active principles is possible.

Other conditions being equal, well cured old crop beans are always to be preferred, for as a general rule they will produce a clear extract with a much less amount of alcohol.

CARE OF FINISHED EXTRACTS.

Finished extracts should be well protected from the decomposing chemical action of strong light, for if this is not heeded the extracts will eventually be ruined.

DEMONSTRATION.

The old habit of testing extracts, particularly vanilla, by eliminating the alcohol by way of friction between the hands, is decidedly impractical, since by this method the exudation from the pores of the skin of the hands adds an odor to the vanilla that certainly does not tend to improve it. The most satisfactory method is with the use of an atomizer, which should be operated up to within about three feet of the prospective buyer. The results in a demonstrative way are all that could be desired, as when vanilla is finely subdivided the alcohol seems to be entirely eliminated while traveling through space, and the buyer gets the full benefit of the vanilla character.

LEMON EXTRACTS

LEMON EXTRACT.

The flavoring preparation next in importance to vanilla is lemon extract. The Federal "Standards of Purity for Food Products" Circular No. 19 defines lemon extract as follows:

"Lemon extract is the flavoring extract prepared from oil of lemon, or from lemon peel, or both, and contains not less than five (5) per cent. by volume of oil of lemon";

and further,

"Oil of lemon is the volatile oil obtained, by expression or alcoholic solution, from the fresh peel of the lemon (*Citrus limonum* L.), has an optical rotation (25° C.) of not less than +60° in a 100-millimeter tube, and contains not less than four (4) per cent. by weight of citral."

Lemon oil is a very complex body, consisting of at least 15 constituents. Of these the terpenes compose about 90 per cent. of the oil, serving mainly as a vehicle for the essential ingredients, viz.: the aldehydes, including citral, 4 to 6 per cent., the alcohols and esters and other compounds 4 to 5 per cent. The entire oil is readily soluble in strong alcohol (80 per cent. or more) which constitutes the most expensive ingredient, since its cost is a trifle over 75 per cent. of the total cost of the extract. Citral is the chief essential ingredient, but citral alone is not lemon, the remaining ingredients being necessary to fully develop the true lemon character.

The terpenes are very prone to decomposition; exposed to the action of light and heat with access of air, they quickly develop an odor and taste of turpentine.

Oil of lemon should be kept in well stoppered containers, in a cool place, protected from the chemical action of light. The contents of an original package, after having a portion removed, can be kept in a fragrant condition by adding to each pound of oil one ounce of alcohol; shake well, and next add one ounce of water and again shake. The water withdraws the alcohol from the oil and collects as dilute alcohol at the bottom of the container, where it should be permitted to remain until the oil has been used, shaking each time the container has been opened. Oil of lemon so treated has been kept fresh and fragrant for fourteen months.

Oil of orange may be treated in a similar manner with excellent results.

Oil of lemon can be kept for an indefinite period under the most unfavorable conditions known if from 1 to 2 per cent. of a fixed oil is incorporated with it. Such oils as cotton and olive are well adapted for this purpose. A test sample treated in this manner has been exposed to the action of heat and light for two years, and at the end of that time did not indicate any deterioration in the least. This method of preserving oil is well adapted to bakers' and confectioners' use, also oils intended for preparing terpeneless extract of lemon; but it is not recommended for use in whole oil lemon, since the existence of the minute quantities of the fixed oil might be opposed by the pure food authorities.

The manufacture of extract of lemon is a very simple process, the formula consisting of a solution of 5 per cent. of oil of lemon in strong alcohol as per the following:

Oil of lemon 6.4 ounces
Grain alcohol 121.6 ounces

128 ounces = 1 gallon

Mix thoroughly, let stand a few hours, and filter.

Bear in mind that this formula contains the minimum allowed by the food laws, and the author would suggest the advisability of employing a larger per cent. of oil, since there is always a liability of error on the part of the manufacturer or analyst, which may result in a food law case. The habit of obeying the law in the letter, rather than in the spirit, is not to be commended.

That this position has been adopted by some of the leading manufacturers is attested by an examination of seven of the most popular brands on the market. The per cent. of whole oil of lemon varied from 8 to 17 per cent., with the precipitation and centrifuge method.

TERPENELESS EXTRACT OF LEMON.

The Federal "Standards of Purity for Food Products" Circular No. 19 defines terpeneless extract of lemon as follows:

"Terpeneless extract of lemon is the flavoring extract prepared by shaking oil of lemon with dilute alcohol, or by dissolving terpeneless oil of lemon in dilute alcohol, and contains not less than two-tenths (0.2) per cent. by weight of citral derived from oil of lemon." "Terpeneless oil of lemon from which all or nearly all of the terpenes have been removed."

Terpeneless oil of lemon is simply the natural oil freed from the terpenes by distillation under vacuum. These terpenes are bodies or chemical compounds which con-

sist entirely of hydrogen and carbon, and while they are considered as inert and worthless as a flavoring medium, they require a strong alcohol for solution. Terpeneless oils of lemon are offered by the trade at prices ranging from \$20 to \$30 per pound, while the percentage of citral varies from between 40 to 65 per cent. The lower grade oils have been freed from only a portion of the terpenes and will not dissolve clear in a 50 per cent. by volume of a 190 proof alcohol.

The words, "nearly all of the terpenes have been removed," no doubt account for the presence on our markets of oil of various strengths and character. When purchasing a terpeneless lemon oil, the most logical method for the manufacturer to pursue would be as follows: Purchase a high-grade oil of a reliable house and request a statement in the form of a guarantee, having reference to the citral content, which should likewise appear on the label; then, and then only, will one be able to intelligently ascertain the amount of oil required. The amount of alcohol required should be sufficient to dissolve the oil (in a clear state) and hold it in solution at the lowest winter temperature to which these extracts would be subject in shipping to the trade, the amount in no instance being less than 50 per cent. by volume of 190 proof.

The use of carbonate of magnesia or any other filtering medium should be discouraged, since more or less of the citral is held back with the terpenes and magnesia, eliminating the element of certainty in computing the per cent. of citral in the finished product; while with the use of the proper oil, no filtering is necessary. Whenever possible, soft or distilled water should be used.

The advantages of terpeneless extract of lemon are as follows: They will not develop a rancid or turpen-

tine flavor on exposure to heat or strong light, because the hydro-carbon—that portion of the oil which readily decomposes—is not present; and, being soluble in water, they readily mix into ices, fountain syrups, etc. There is a saving of about 50 per cent. of alcohol, and they can be produced at the lowest possible cost for the strength, purity and permanence of flavor obtained. It is undoubtedly true that this class of products is useful as a flavoring agent, but, as is true of all such products, they should be labeled exactly what they are.

MANUFACTURE OF TERPENELESS LEMON EXTRACT.

Various methods have been employed in the manufacture of terpeneless extract of lemon, the following being among the most popular:

First—What is known as the “shaking out” process consists of placing the oil and dilute alcohol into an airtight container and churning for a considerable length of time; then allowing the mixture to stand until the oily portion rises to the top, when the lower stratum is drawn off and filtered with the aid of magnesium carbonate or kieselguhr (an infusorial earth) to remove globules of oil held in suspension. The degree of citral removed depends, first, upon the alcoholic strength, and second, upon the thoroughness of the agitation, facilitating the extracting alcohol to come into close contact with the very minute globules of whole oil of lemon. The oily residue is generally subjected to a second churning process, in an effort to remove the entire amount of the delicate flavoring constituent, viz.: citral, which is the principal flavoring ingredient in oil of lemon.

Second—Place the lemon oil and alcohol into a suitable container (an alcohol barrel free from glue) and

agitate occasionally during a period of twenty-four hours; next add magnesium carbonate or kieselguhr (about $\frac{3}{4}$ ounce to each gallon), shake thoroughly and add the water lukewarm, shaking thoroughly after each gallon addition, and, when complete, agitate or churn for at least one day; next place the barrel on a rack and allow the filtering medium to subside; next syphon off the almost clear liquid, being careful not to insert the hose too close to the filtering medium at the bottom of the barrel. In this manner the filtering operation will operate quite rapidly. Lastly, place the remaining portion of the mixture into the filter, using either heavy white paper or felt. A great deal of conscientious care and good judgment must be exercised in this process; otherwise a considerable waste of materials will result. The filtering medium will, in both cases, be found to contain the terpene product, together with considerable of the extract, and this can be recovered by placing the medium into a close-mesh cotton or linen bag and then putting the bag into a powerful screw press to express the products. Two distinctive layers will result; the lower, which is the extract and which can be syphoned off, and the upper, the objectionable terpene principle.

The basis for computing the strength of a lemon extract lies in the percentage of the citral it contains. An extract made from the whole oil will contain about .2 per cent. of citral in the finished extract, provided that 5 per cent. of oil has been used. Lemon oil usually contains about 4 per cent. of citral; therefore, in the finished extract there will be $.05 \times .04 = .002$, or .2 per cent. Theoretically, 5 per cent. of whole lemon oil, containing 4 per cent. of citral, should yield the required .2 per cent. of citral to a terpeneless lemon extract made by the shaking-out process. In practice, this is far from being correct,

due mainly to the fact that more or less of the citral is withheld in the terpenes and filtering medium. The safest course to pursue would be the employment of at least 8 per cent. of oil as per the following formula:

Spirits 190 proof	59	ounces
Water (lukewarm)	59	ounces
Oil, lemon	10 $\frac{1}{4}$	ounces

Third—By simply dissolving terpeneless lemon oil in dilute alcohol. Processes No. 1 and No. 2 have been in use many years and are still quite extensively practiced. Practically all advantages as regards certainty of citral content and cost and labor are in favor of the simple method of dissolving terpeneless lemon oil in suitable strength alcohol, as per the following formula:

Terpeneless oil of lemon (assaying 66% citral)	3 $\frac{1}{8}$	drams
Spirits 190 proof	$\frac{1}{2}$	gallon
Water (soft preferred)	$\frac{1}{2}$	gallon

Add the oil to the spirits and shake well; next add the water, gradually shaking after each addition; then filter through paper, if necessary. To determine the citral content in the finished product, proceed as follows:

8 drams=1 ounce; 128 ounces=

1 gallon, or.....	1024	drams
add to the above the oil used....	3 $\frac{1}{8}$	drams

and employ the total as the divisor; 1027) 3.125 (.00304 for the dividend take the amount of oil used; the quotient represents the per cent. of oil employed; next multiply the per cent. of oil used by the per cent. of citral contained in the oil:

$$\begin{array}{r}
 .304 \text{ representing the per cent. of oil used} \\
 .66 \text{ representing the per cent. of citral con-} \\
 \hline
 \text{tent of the lemon oil} \\
 1824 \\
 1824 \\
 \hline
 \end{array}$$

0.20064 representing the per cent. of citral in the finished product, provided that no filtering medium has been employed.

To ascertain the amount of terpeneless oil required to contain the necessary $2/10$ per cent. citral in the finished product, using an oil assaying 60 per cent. citral, proceed as follows:

Per cent. of citral in the oil of lemon
is the divisor..... .60) .002000 (.0034
Per cent. of citral in finished prod-
uct is the dividend
Per cent. of oil required is the quo-
tient
Number of drams to the gallon 1024
Times per cent. of oil required .0034

3.4816 drams to the gal.

The grated exterior rinds of fresh yellow lemons are a valuable addition to any lemon extract, adding character and piquancy, in fact, all that could be desired in a high-grade product.

LEMON FLAVOR—IMITATION.

All grades of lemon extracts below the standards specified under "Lemon extract" and "Terpeneless lemon extract" must be labeled, sold and invoiced as imita-

tions. All products labeled and sold as imitations do not require a specified standard of purity or strength; hence, by varying the proportions of formulas submitted, extracts of almost any desired strength and cost can be made. At this time, the Federal and most State laws permit the use of coloring, provided the colors used are plainly stated on the label and are of the "certified" type. The great advantage which the use of certified colors offers to the food products manufacturers is clearly set forth in F. I. D. (Food Inspection Decision) No. 117, as follows:

"Food Inspection Decision No. 76, published July 13, 1907, gives a list of seven coal tar dyes which may, without objection from the Department of Agriculture, be used in foods until further notice. Food Inspection Decision No. 77, published September 25, 1907, provides for the certification of dyes. Certified dyes may be used in foods without objection by the Department of Agriculture, provided the use of the dye in food does not conceal damage or inferiority."

Uncertified coal tar dyes are likely to contain arsenic and other poisonous elements which, when used in food, may render such food injurious to health, and, therefore, would be adulterated under the law.

The active principle of imitation lemon is composed chiefly of citral or lemongrass. One ounce of citral is equivalent in flavoring power to one pound of oil of lemon, but is decidedly deficient in delicacy and character of the real lemon oil. Commercial citral is not a synthetic product, its common source being lemongrass, separated by distillation. The per cent. of citral content of lemongrass varies from 60 to 75 per cent. Citral occu-

pies the same relation to lemon flavor as coumarin does to vanilla, but it does not blend nearly as well. In the following formulas the use of citral or lemongrass are optional. There are three grades of lemongrass on the market, viz.: Native, rectified and Java, their relative values being in the same order:

Terpeneless oil of lemon	½ dram
Citral	½ dram
Oil of lemon	4 ounces
Alcohol	3 pints
Water (lukewarm)	5 pints
Magnesia—carbonate	2 ounces

Dissolve the oils in the alcohol, mix the magnesia and water, and add slowly together, shaking thoroughly off and on for one day; filter through paper.

Lemongrass	4 drams
Alcohol	32 ounces
Water (lukewarm)	96 ounces
Carbonate—Magnesia	1 ounce

Treat as above.

EXTRACT OF ORANGE.

The Federal standard of extract of orange and terpeneless extract of orange corresponds in all respects to lemon extract. As in the case of the lemon, the use of the grated outer rind of the orange is a valuable addition to orange extract. There are no substitutes for orange flavors, the cheapest practical formula consisting of the terpeneless.

VARIOUS EXTRACTS

EXTRACT OF ALMOND.

"Almond extract is the flavoring extract prepared from oil of bitter almonds, free from hydrocyanic acid, and contains not less than one (1) per cent. by volume of oil of bitter almonds."

Oil of bitter almonds, commercial, is the volatile oil obtained from the seed of the bitter almond (*Amygdalus communis* L.), the apricot (*Prunus armeniaca* L.), or the peach (*Amygdalus persica* L.).

No. 1.

Oil of almond	3 ounces
Spirits	5 pints
Water	3 pints

Dissolve the oil in the alcohol and add water gradually, shaking after each addition; filter if necessary.

No. 2.

Oil of almond	1 3/10 ounces
Spirits	52 ounces
Water	76 ounces

Proceed as in formula No. 1.

A very satisfactory imitation can be prepared by the use of "Benzaldehyde," but, like all other synthetic flavors, is inferior to the natural product when used in the cold, but it withstands heat better.

No. 3.

Benzaldehyde	1 ¼	ounces
Spirits	45	ounces
Water	83	ounces

Proceed as above.

WINTERGREEN EXTRACT.

"Wintergreen extract is the flavoring extract prepared from oil of wintergreen, and contains not less than three (3) per cent. by volume of oil of wintergreen." "Oil of wintergreen is the volatile oil distilled from the leaves of the *Gaultheria procumbens* L."

No. 1.

Oil of wintergreen	4	ounces
Spirits	90	ounces
Water	38	ounces

Imitation wintergreen is prepared by the use of oil of sweet birch, or Methly salicylate.

No. 2.

Oil of sweet birch, or methyl salicylate	3 ½	ounces
Spirits	76	ounces
Water	52	ounces

Mix, and filter if necessary.

EXTRACT OF PEPPERMINT.

"Peppermint extract is the flavoring extract prepared from oil of peppermint, or from peppermint, or both, and contains not less than three (3) per cent. by volume of oil of peppermint." "Oil of peppermint is the volatile oil

obtained from peppermint and contains not less than fifty (50) per cent. by weight of menthol."

Substitutes for peppermint of a practical character are not known.

No. 1.

Oil of peppermint 4 ounces
Spirits 1 gallon

Mix. This product can be colored with the use of peppermint leaves to suit.

In the event of a cheaper product being desired, prepare a terpeneless extract either by the use of terpeneless oil of peppermint or by the "shaking out" process, as prescribed for terpeneless extract of lemon. Since these products fall below the legal standard, they should be labeled, sold and invoiced as an imitation.

EXTRACT OF GINGER.

"Ginger extract is the flavoring extract prepared from ginger and contains in each one hundred (100) cubic centimeters the alcohol-soluble matters from not less than twenty (20) grams of ginger."

No. 1.

Jamaica ginger (coarse powder) 2 pounds
Spirits 1 gallon

Place the ginger in a narrow percolator, using no force in packing, always providing sufficient washed-fine excelsior in the apex of the percolator to retain the ginger; next pour on the alcohol, and when the entire mass is submerged, cork the delivery and cover the top and let stand for several days; then percolate.

Another method, in the absence of a percolator, is to place the ginger and spirits in a suitable air-tight con-

tainer, such as a packing bottle or a keg, and shake frequently for a few days; next place the mass on a coarse paper filter and finish.

Jamaica ginger is always to be preferred to any of the lower grades, since the character is not only the finest, but the tendency of precipitates (sediment) is reduced to a minimum.

No. 2.

Oleo-resin ginger (1%)	1.28 ounces
Spirits	$\frac{3}{4}$ gallon
Water (soft)	$\frac{1}{4}$ gallon

Dissolve the oleo-resin in the spirits and gradually add the water lukewarm, shaking after each addition; let stand for a few days; filter through paper, using a small amount of precipitated calcium carbonate as a medium if necessary.

For a cheaper product the soluble essence is recommended, as follows:

No. 3. Soluble.

Jamaica ginger (coarse powder)....	4 pounds
Pumice stone (powdered)	4 ounces
Lime (slacked)	4 ounces
Spirits (dilute, equal parts)	1 gallon

Rub the ginger with the pumice stone and lime until thoroughly mixed. Moisten with the dilute alcohol until saturated, and place in a narrow percolator, being careful not to use force in packing, simply placing it in to obtain the position of a powder to be percolated, so that the menstruum will flow through uniformly. Next add the dilute alcohol and percolate until one gallon of the percolate is obtained. Let stand twenty-four hours, and filter if necessary. The pumice should be repeatedly washed in water prior to using.

No. 4. Soluble.

Fluid extract of ginger (U. S. P.)... 8 ounces
 Pumice, powdered and washed 2 ounces
 Water, quantity sufficient to make.. 24 ounces

Pour the fluid extract of ginger into a bottle and add the pumice, shaking thoroughly; repeat the operation for several hours; next add the water in the proportion of about two ounces at a time, shaking after each addition. When all is added, repeat the agitation occasionally during twenty-four hours, then filter, returning the filtrate until it comes through clear, and, if necessary, add sufficient water to produce the required 24 ounces of finished product.

EXTRACT OF ROSE.

“Rose extract is the flavoring extract prepared from otto of roses, with or without red rose petals, and contains not less than four-tenths (0.4) per cent. by volume of otto of roses.”

Otto of roses is the volatile oil obtained from the petals of *Rosa damascena* Mill., *R. moschata* Herrm.

No. 1.

Oil of rose (otto) ½ ounce
 Spirits 1 gallon

Mix and filter if necessary.

There are a number of desirable artificial rose oils on the market, soluble in dilute 3 to 1 spirits, suitable for imitation products, costing but 25 per cent. of that of the genuine oil. To increase the tone or piquancy of this product, use rose geranium of the very best quality, as per the following:

No. 2.

Oil of rose (artificial)	2 drams
Oil rose geranium (best quality)...	½ dram
Oil of clove (amboyna)	24 minims
Spirits	3 quarts
Water	1 quart

Filter with carbonate of magnesia if necessary. Label an imitation.

EXTRACT OF ALLSPICE.

The Government standards do not include allspice.

Oil of allspice (pimento)	2 drams
Allspice (coarse powder)	3 ounces
Spirits (dilute)	2 pints

Mix, macerate for several days, and filter.

ANISE EXTRACT.

“Anise extract is the flavoring extract prepared from oil of anise, and contains not less than three (3) per cent. by volume of oil of anise.”

“Oil of anise is the volatile oil obtained from the anise seed.”

Oil of anise	4 ounces
Spirits	1 gallon

Mix and filter if necessary.

CELERY EXTRACT.

“Celery seed extract is the flavoring extract prepared from celery seed or the oil of celery seed, or both, and contains not less than three-tenths (0.3) per cent. by volume of oil of celery seed.”

"Oil of celery seed is the volatile oil obtained from celery seed."

Oil of celery seed	3½	drams
Spirits	3	quarts
Water	1	quart

Mix and filter if necessary.

EXTRACT OF CINNAMON.

"Cinnamon extract is the flavoring extract prepared from oil of cinnamon, and contains not less than two (2) per cent. by volume of oil of cinnamon."

"Oil of cinnamon is the lead-free volatile oil obtained from the bark of the Ceylon cinnamon (*Cinnamomum zeylanicum* Breyne), and contains not less than sixty-five (65) per cent. by weight of cinnamic aldehyde and not more than ten (10) per cent. by weight of eugenol."

Oil of cinnamon	2.56	ounces
Spirits	90	ounces
Water	38	ounces

Thoroughly shake the oil with the alcohol and add the water gradually, shaking after each addition; filter if necessary.

The standard for cassia extract is the same as that for cinnamon, but the oil specification is somewhat different, as follows:

"Oil of cassia is the lead-free volatile oil obtained from the leaves or bark of the *Cinnamomum cassia* Bl., and contains not less than seventy-five (75) per cent. by weight of cinnamic aldehyde."

EXTRACT OF CLOVES.

"Clove extract is the flavoring extract prepared from oil of cloves, and contains not less than two (2) per cent. by volume of oil of cloves."

Formula is the same as that for cinnamon extract.

EXTRACT OF MINT (SPEARMINT).

"Spearmint extract is the flavoring extract prepared from oil of spearmint, or from spearmint, or both, and contains not less than three (3) per cent. by volume of oil of spearmint."

Formula same as for anise extract.

EXTRACT OF CHOCOLATE.

(No Government Standard.)

Curacao cocoa 1½ pounds

Dilute spirits (equal parts) 1 gallon

Mix thoroughly and macerate for from five to ten days, shaking occasionally, and filter or percolate; addition of extract of vanilla is an improvement.

EXTRACT SARSAPARILLA—SOLUBLE—AN IMITATION.

Oil of wintergreen 1 ounce

Oil of sassafras ½ ounce

Oil of cassia (or cinnamon) 1 dram

Oil of fennel 1 dram

Oil of caraway 1 dram

Oil of anise 4 drams

Alcohol and water of each ½ gallon

Caramel color to suit.

Dissolve the various oils in the alcohol and rub with three ounces of carbonate of magnesia in a mortar. Transfer the mixture into a bottle and add the water, shaking after each addition; allow to macerate for a few days, and filter through paper, adding sufficient water through the paper to make one gallon.

EXTRACT PISTACHIO IMITATION.

No. 1.

Extract of almond	2 ounces
Extract of vanilla	4 ounces
Oil of neroli	1 drop

Mix.

No. 2.

Oil of orange	4	drams
Oil of cassia or cinnamon.....	1	dram
Oil of nutmeg	1½	drams
Oil of bitter almonds	15	minims
Oil of calamus	15	minims
Oil of cloves	30	minims
Spirits	12	ounces
Water	4	ounces

Magnesia, carbonate	3	drams
---------------------------	---	-------

Dissolve the various oils in the alcohol and rub with the magnesia; add the water with agitation; let stand a few hours, and filter.

ETHEREAL IMITATION FLAVORS.

Such flavors as pineapple, strawberry, banana, raspberry, cherry, etc., are prepared from concentrated fruit ethers. Owing to the large number of individual ethers required to compound the various flavors, considering the

small demand in general and the variations of formula, it is more economical, as well as more satisfactory, to purchase from a reliable essential oil house the mixed ethers representing the flavors desired. These ethers were formerly known as "Fruit Oils," but under the Federal Food and Drugs Act this term has gone into disuse.

As to the status of these ethereal flavors under the food laws, there is pending at present under the Pennsylvania State law litigation as to whether Amyl Acetate and, possibly, one or two other ethers may be used in food products. Undoubtedly the general disposition of food officials is against such substitute materials. They have never been very popular, but certain sections of the country enjoy a fair demand. It is necessary so to label them that no complaint can be made of misbranding under the food laws.

They are made into the ordinary strength by a simple reduction with alcohol and water in the following proportions:

Concentrated pineapple ether	3 ounces
Spirits	$\frac{1}{2}$ gallon
Water	$\frac{1}{2}$ gallon

Dissolve the ether in the alcohol, and gradually add the water and filter.

Laboratory Notes

Menstruums (Solvents).

Alcohol, being the most extensively employed, will be considered first. Alcohol is a volatile, inflammable, colorless liquid (C_2H_5OH) of a penetrating odor and burning taste. In commerce the alcohol produced from maize or other grain is known as ethyl or grain alcohol. It should be kept in well stoppered containers, and in a cool place, remote from fire. When alcohol and water are mixed together, a rise in temperature and contraction in volume take place. In small operations the contraction is generally disregarded; in larger operations the loss is very apparent. If fifty-five gallons of alcohol be mixed with forty-five gallons of water, the total will not be 100 gallons of dilute alcohol, but only $96\frac{1}{4}$ gallons, showing a loss of $3\frac{3}{4}$ gallons.

One gallon of 190 proof alcohol, temperature $15.6^\circ C$. ($60^\circ F.$), specific gravity 0.816, weighs 6 pounds 12 ounces and 339 grains.

Proof Spirit is a term used by the Revenue Department in assessing the tax on alcoholic liquors. It means a liquid in which there is 50 per cent. (by volume) of absolute alcohol. As it is the actual alcohol in the whiskey, brandy, dilute alcohol, etc., which is taxed, and as this varies widely, it is necessary that the actual wine gallons be converted into proof gallons before the tax rate can be fixed. A sample that is half alcohol and half water is "100 proof." A sample that is three-quarters alcohol and one-quarter water is 150 proof, and the tax on every gallon of it is one and a half times the regular Government rate per proof gallon. Absolute alcohol is

200 proof and is required to pay a double tax. The legal definition of *proof spirit* is: "That alcoholic liquor which contains one-half its volume of alcohol of a specific gravity of 0.7939 at 60° F."

Rule for Diluting Alcohol (Pile's).

To reduce alcohol to any desired strength: To as many parts of the given alcohol as are indicated by the percentage required, add sufficient water to make the number of parts of the mixture equal to the percentage of the given alcohol.

Example: If it is desired to make an alcohol of 30 per cent. from one of 95 per cent., take 30 fluid ounces of the alcohol and add a sufficient amount of water to make 95 fluid ounces.

The alcohol best suited for the manufacture of flavoring extracts is what is known as true deodorized or Cologne spirit, or alcohol free from fusel oil. A mixture of 10 cubic centimeters of alcohol and 0.2 cubic centimeter of potash lye evaporated down to one cubic centimeter should not give any odor of fusel oil after supersaturation with dilute sulphuric acid. Deodorized alcohol should not possess a foreign odor and should mix with water without becoming turbid.

Water as a solvent in flavoring extracts is next in importance. Ordinary water always contains solid matter, and traces of various salts in solution or suspension; while this solid matter and salts do not ordinarily unfit it for drinking purposes, they do, in many instances, seriously interfere with the preparation of flavoring extracts. In some sections of the country, the drinking water might be pure enough for the processes, or, at least, it does not contain serious impurities; in other sections, the water would be totally unfit for the preparation

of flavoring extracts. Soft or distilled waters are always to be preferred.

Brief Rules for Qualitative Tests of Water.

No. 1. If the water reddens blue litmus paper before boiling but not afterward, and the color of reddened paper is restored upon warming, it is carbonated.

No. 2. If it possesses a nauseous odor and gives a black precipitate with acetate of lead, it is sulphurous.

No. 3. If it restores blue color to litmus paper after boiling, or develops a red color on the addition of a phenolphthalein test solution, it is alkaline.

No. 4. If it possesses neither of the above properties in a marked degree and leaves a large residue upon evaporation, it is a saline water.

When water is pure, it will not become turbid or produce a precipitate with any of the following reagents:

Baryta water, if a precipitate or opaqueness appears, carbonic acid is present.

Chloride of barium indicates sulphates.

Nitrate of silver indicates chlorides.

Oxalate of ammonia indicates lime salts.

Boiling for five minutes and filtering when cool will, in many instances, make objectionable water suitable for extract purposes.

FILTRATION.

Filtration is the process of separating liquids from solids, with the object of obtaining a liquid in a transparent condition. The intervention of porous substances, termed filters, to intercept solid particles is necessary in performing this process. They are usually made from paper, paper pulp, linen, felt, etc. Paper filters are the

most useful of all kinds and are employed in general operations requiring fine filtration, since the solid particles are much more completely separated by paper than by strainers, owing to the pores of the paper being smaller and more numerous.

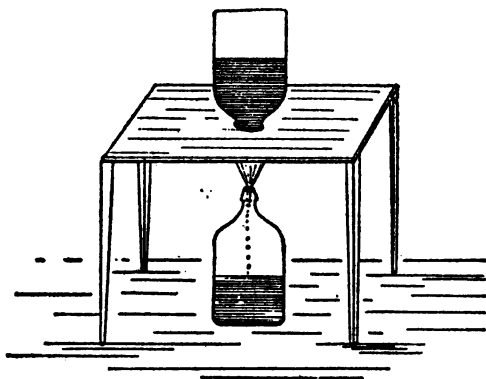
When folding a filter, care should be observed not to extend the creases entirely to the apex, but to terminate them at a distance of about $\frac{1}{2}$ inch from it, since the point at which all creases converge would thereby be so weakened that the weight of the liquid would rupture the filter. When pouring the liquid in the filter, the stream should never be delivered upon the apex, but upon the sides, feeding in a circular motion, so that the force of the fall will be broken before the weakest point is reached. In filtering liquids composed mostly of water the paper is very liable to be broken, since the water tends to soften it (while alcohol has a reverse action) ; the use of a small tuft of absorbent cotton in the apex of the filter will, in a large measure, overcome this trouble. The filter paper should be entirely within the funnel, since, if the edge of the paper projects above the funnel, waste ensues from evaporation of volatile liquids, as well as from the increased and unnecessary absorption due to the excess of the filtering paper ; in addition, an untidy and careless habit is formed.

The filtering papers in the market are of three weights: light, medium and heavy ; and of two colors: white and gray. For general purposes the French filters are almost universally used, the "Prat Dumas" brand being the most common. The gray filters are made from a mixture of cotton, flax, wool, etc., and are well adapted for filtering colored liquids or tinctures, but, owing to the coloring matter they contain, they are not practicable for liquids containing free alkali. Ribbed-glass funnels

are always to be preferred, as they operate more rapidly than the plain. Felt filters are made bag-shaped and are admirably adapted in operations where a large amount of liquid is to be filtered and in cases where a filtering medium is employed. They are made in sizes ranging from one to five gallons' capacity, and operate very rapidly. When using such a filter on volatile liquids it should be enclosed in a tight-fitting filtering cabinet, provided with a glass door; for, if this is not done, the evaporative loss due to the large surface exposed to the atmosphere will be quite large. Filtering mediums are finely powdered substances used to facilitate the operation of filtering. They operate on the principle of adhering to or entangling the objectionable suspended matter, thereby preventing it from rapidly obstructing the pores of the filter.

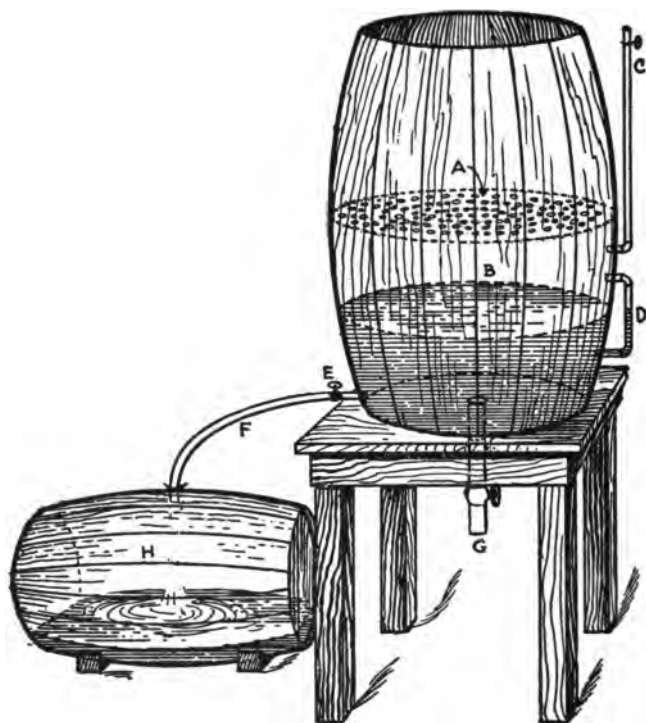
The following substances are generally used for this purpose: Magnesium carbonate, purified talcum, washed pumice, precipitated calcium carbonate, precipitated calcium phosphate and kieselguhr (an infusorial earth). For operations on liquids containing acids, talcum and pumice are recommended, since the employment of the carbonates results in a chemical change.

Filtering liquids of a volatile character should be conducted in the least possible time, and, to facilitate this condition, the filter must constantly be kept full, so that the maximum benefit of the filter surface can be utilized. For this purpose the automatic feeding or continuous filtration principle is recommended (see figure). The use of the containers termed skeleton demijohns is especially recommended. The bottles are clear glass, affording opportunity for minute and intelligent inspection of the contents. The protection against breakage at the bottom is perfect, while the four upright canes or standards af-



ford security for the sides and serve as substantial handles. These bottles are made in three sizes: two, three, and five gallons' capacity, respectively.

The capacity of the container does not affect the principle involved, but in all cases both bottles should be of the same capacity, since, under such conditions, the operations can be conducted over night and on Sunday, without the danger of overflowing the receiver. This process is adapted equally for use with the felt or other forms of filters. In principle, when the apparatus is in action, the liquid cannot escape from the upper container after the funnel is full as high as the mouth of that container, for the simple reason that the liquid in the funnel regulates the ingress of air. After the liquid escapes through the filter, receding from the mouth of the inverted container, air rushes in, more liquid runs out, and the supply in the funnel is thus kept up automatically until all the liquid has run from the upper bottle or demijohn.



DOUBLE PRESSURE FILTER AND PERCOLATOR

DOUBLE PRESSURE FILTER AND PERCOLATOR.

(See Fig., page 58.)

In all filtering operations of 15 gallons or more, the most satisfactory results are obtained with the use of the Double Pressure Filter and Percolator, operating on the following principle: Cocks "E" and "G" are closed while vent valve "C" is opened; the material to be filtered or percolated is next placed on perforated disc (clothed with felt or paper) "A," drawing off samples at cock "G" and returning until the filtrate or percolate runs perfectly clear. At this stage, close cock "G" and when the liquid in space "B" reaches about 10 inches in height, close valve "C" and open cock "E." A portion of the liquid will rapidly flow into receiver "H," but in the absence of sufficient vent, a partial vacuum is formed in space "B" and henceforth the flow into the receiver is in ratio to the flow through the perforated disc "A." Thus we have a double pressure, viz.: the weight of the liquid on top of the disc, plus the partial vacuum, or, as it is ordinarily understood, the suction of the lower column of liquid, the operation thus producing a finer filtrate in a shorter period. The cock "G" is designed for use in determining the character of the filtrate at the beginning of the operation, as before stated; also as an exit for waste water when washing out the apparatus. The glass gauge "D," while not a necessity, will be found a convenience. All fittings should be of brass, preferably tinned.

To construct a filter of this type, proceed as follows: Select an alcohol barrel in good condition; carefully remove the head; next thoroughly remove all of the glue, if any. Next bore a $\frac{1}{2}$ -inch hole in the bottom and se-

curely fasten a $\frac{1}{2}$ -inch flange coupling and insert a brass nipple so that the end will come up flush on the inside, providing means for thoroughly draining; on this nipple fasten the cock. Insert a nipple at "E" and use lock nuts on both sides to thoroughly secure it, and screw on the cock. In a like manner, insert a nipple for vent pipe "C," bring up to top of barrel and end with valve.

Should you decide to use a glass gauge, it will be necessary to place it at this time. The wood disc should be made of $\frac{1}{2}$ -inch oak and securely fastened at the center of the barrel; it should be made in two sections to facilitate placing it in position. This disc should contain a very liberal amount of perforations of about $\frac{1}{4}$ -inch diameter; the more perforations the better. After this is completed, the entire disc should be clothed with a piece of thick felt or paper, securely fastened around the entire circle; the filter is then ready for use. A filter of this design can be constructed of metal, but oak is much preferable on extract work, particularly vanilla.

When through with the filter, always clean it at once in the following manner: Remove all of the magma (solids) from the filtering disc, next add hot water and operate as in filtering, with the exception of drawing off at cock "G," and, when through, leave all portions of the filter open to the air, including valves and cocks, thereby eliminating the tendency of the formation of must and foreign odors. A filter of this class will operate with the minimum evaporative loss, since the liquids at no time are exposed to the atmosphere, and can be fed automatically from an exterior source (an inverted container or syphon). The labor for results obtained is the minimum and the filter will last for years. The receiver should, in all cases, be of the same capacity as the amount operated on, thus eliminating any danger of overflowing.

SIMPLE METHODS OF TESTING.

The presence of fixed (fatty) oils, such as poppy-seed, castor and other bland resinous oils, can readily be determined by placing a few drops on clean white blotting paper and exposing the paper to a mild heat; if the oil is pure, the spot on the blotter disappears immediately. To fully substantiate this test the blotter should be held up to the light, and if no permanent stain is visible, the oil can be accepted as free from fixed oils.

Alcohol is sometimes added to essential oils of high value. To detect, add a small portion in a graduated test tube and carefully drop in a small amount of water; if alcohol is present, the drops will be surrounded with a milky (turbid) circle; next, add more water and shake, and after the liquids have separated, the approximate per cent. of alcohol present can be computed by the increased volume of the upper layer. Another method consists of agitating with the oil in a test tube a few small pieces of dried chloride of calcium. These will remain unchanged if the oil is pure, but they will dissolve in an oil containing alcohol, and the resulting solution will form a distinctive layer on the bottom of the container.

A more accurate test of the presence of alcohol in an essential oil is accomplished by the use of metallic sodium or potassium. Place fourteen drops of the oil on a perfectly dry watch glass, and put a piece of sodium or potassium, the size of a pin's head, in the center of it. If the alkali remains unchanged for twenty minutes, no alcohol is present, but if it disappears after five minutes, the oil contains at least 4 per cent. of alcohol; if it disappears in less than one minute, it indicates the presence of not less than 20 per cent. of alcohol.

To Test Oil of Lemon.—The presence of purified turpentine in oil of lemon is not so easily detected on account of its similar composition and specific gravity. By adding three volumes of strong alcohol with one volume of the oil, the turpentine, if present, will remain undissolved, and by evaporating a small quantity on a blotting paper and shaking the paper in the air, the presence of this adulterant will be indicated by the terebinthinate (turpentine) odor, using a similar test for comparison with an oil of known purity.

The most dangerous adulterant in oil of lemon is citrene, the terpene principle obtained as a by-product in the extraction of citral from oil of lemon, while preparing terpeneless oil.

To Test the Purity of Oil of Cloves.—Oil of cloves, when pure, will manifest the following reaction: When shaken with pure liquor of ammonia, it coagulates and crystallizes after fusion by a gentle heat; treated with an alcoholic solution of potassa, it congeals into a crystalline mass with total loss of its odor. A solution of potassium chromate transforms it into brown flakes, while the yellow color of the salt is dissipated. A negative result indicates an addition of inferior oils.

To Test the Purity of Oil of Bitter Almonds.—Oil of bitter almonds is sometimes adulterated with nitro-benzole, and this may be detected by the use of a solution of potassa. The liquid has a green color if nitrate-benzole is present, and upon dilution three layers are formed, the lower yellow, the upper green; over night, the green color changes to red.

To Test the Purity of Otto of Roses.—The principal adulterants to be found in otto of roses are the oils of rhodium, geranium, sandalwood and camphor, and occasionally spermaceti, which is added to contribute the crys-

talline appearance. Otto of rose, when pure, has a bland, sweet taste; if it is bitter, this indicates the presence of rhodium or sandalwood; if it is pungent or biting to the palate, it contains either oil of geranium or camphor, or both; if it imparts an unctuous sensation to the palate, or if it responds to the blotter paper test for fixed oils, it contains spermaceti. A single drop of otto, placed on a watch glass with one drop of concentrated sulphuric acid (C. P.) and stirred with a glass rod, will retain its purity and color, but a sample adulterated with other oils is rendered more or less brown and develops peculiar odors, *i. e.*, from oil of geranium, strong and disagreeable; from oil of rhodium, increased and rendered unctuous and resembling cubeb; from camphor, characteristic and combined with acidity; from spermaceti, unctuous and clearly perceptible.

The specific gravity of an essential oil is not an infallible indicator, and this method should be employed only after all other known methods of detection have been resorted to.

ESTIMATION OF SMALL QUANTITIES OF ESSENTIAL OILS.

To determine the per cent. of essential oil in flavoring extracts, proceed as follows:

Howard Method.—Twenty c.c. of the extract are diluted with 50 c.c. of water and one drop of hydrochloric acid (except in case of clove and cinnamon extracts, when the acid is unnecessary). The liquid is then extracted in a separator with three successive portions of 15 c.c., 10 c.c. and 5 c.c. of ether. The mixed ethereal extracts are washed with 10 c.c. of water that has been previously saturated with ether, so as to remove practically all of the alcohol. The ether solution is now transferred to a Babcock milk bottle, which is immersed in warm water and the ether driven off. Water is now added and the bottle is placed in the centrifugal apparatus, and the essential oil read off in the bottle in the same way as with milk fat. The author claims that this process renders very accurate results, as the essential oil is scarcely exposed to heat, and there is, therefore, little risk of loss by evaporation.

TO DETERMINE THE PER CENT. OF GAS IN AQUA-AMMONIA.

The "Baume" hydrometer for ammonia renders fairly good results, provided no alkaline salts to any appreciable extent are present; this condition can be determined by evaporation over a steam bath. For comparative testing the use of the burette will be found more accurate, using a standard acid solution in the burette and 15 c.c. of ammonia with a drop of phenolphthalein indicator added to it, and continuing the flow until exactly neutralized.

TO DETERMINE THE PER CENT. OF ACIDITY (AS ACETIC ACID) OF VINEGAR.

Fill a 50 c.c. burette to zero point with "standard alkali solution." Fill pipette by suction with vinegar to be tested; cover mouth end with finger and allow the vinegar to fall exactly to 6 c.c. mark and place the vinegar in a porcelain dish until exactly at zero mark. Add a little pure water to the vinegar (distilled preferable) until nearly colorless; next add a drop of indicator, and by opening the pinch-cock add standard alkali solution from the burette until a permanent faint pink color appears, stirring with glass rod meanwhile. With a 45-grain (4.5%) vinegar, about 40 c.c. of alkali solution may be quickly added to the vinegar; then it should be added, drop by drop, until a faint pink color is permanent. *The number of c.c. of alkali solution used indicates the acid strength in grains, which, divided by ten, gives per cent. of acidity (as acetic acid).* For a strong vinegar (over 50 grains) fill the pipette to 3 c.c. mark only and multiply the burette reading by two.

The "standard alkali solution" used for the above test can be obtained from any reliable consulting chemist or dealer in chemical supplies, and is known as a tenth-normal alkali solution, being a 0.4 per cent. solution of sodium hydrate, very exactly standardized, against tenth-normal acid which has, in turn, been exactly standardized by calcite or other scientific means.

The indicator solution is prepared by dissolving about 2 per cent. of the phenolphthalein in strongest alcohol and diluting with an equal volume of distilled water.

TO PURIFY ESSENTIAL OILS DETERIORATED FROM AGE.

There are several oils that by absorption of oxygen from the air and from the chemical effect of light rays will become camphorated, grow turbid, deposit a residue (generally called stearopten) and lose more or less of their natural flavor, and, in the case of lemon oil, will acquire the odor of crude turpentine. Such oils as are free from oxygen are chiefly subject to these changes. Oils that have deteriorated in the manner indicated may be improved, but they can never be fully restored to their original condition.

There are various methods employed: The most practicable is redistillation, mixing the oils first with water and incorporating a small amount of alkali; or by agitation for thirty minutes with a thick paste consisting of powdered borax, animal charcoal and water, and filtering. The latter process renders excellent results with almost all essential oil restorations. Another method is to add 10 per cent. of warm water, shake well for fifteen minutes, let settle, draw off by means of a syphon, and filter through paper. Another process is the use of a potassium permanganate solution as follows: Dissolve one ounce of the salt in seven ounces of water and thoroughly agitate with four pounds of the oil, decant, mix with fresh water, and heat gently until the oil assumes a clear condition; then separate and filter.

MISCELLANEOUS RECEIPTS.**PLAIN OR SIMPLE SYRUP.**

Granulated cane sugar 30 pounds
Water (boiling) 7 quarts

Pour the sugar into the water gradually, stirring meanwhile, and when dissolved, strain through coarse cotton cloth. Do not cover container until thoroughly cooled. This will produce four gallons of syrup. The relative proportions of sugar and water are very important since, if a smaller amount of sugar is employed, fermentation sooner or later will ensue. If too much sugar is used, crystallization will surely follow, resulting in a liquid too thin to keep under ordinary temperature.

SODA FOAM.

Soap bark, chips or coarse ground. $1\frac{3}{4}$ pounds
Alcohol, 190 proof..... 2 pints
Water, quantity sufficient to make. 1 gallon

Mix the bark with 6 pints of water, boil for 10 minutes and strain. Add enough water (hot) through the strainer to make 6 pints of tincture and when cool add the alcohol. Let stand over night and filter. One fluid ounce of this tincture is sufficient for one gallon of syrup.

FRUIT ACID SOLUTION.

Citric acid in crystals 2 pounds
Alcohol, 190 proof 1 pint
Water (distilled preferred) to make. 1 gallon

Dissolve the acid in the water, add the alcohol, set aside for a few hours, and filter through paper. One ounce of this is sufficient for one gallon of syrup.

For soda-fountain syrups, add from 2 to 4 ounces of flavor and color to suit.

SEALING OR BOTTLE-TOPPING WAX.

No. 1.—Elastic Enamel Wax.

Good white glue	1	pound
Oxide of zinc	1	ounce
Precipitated chalk	1	ounce
Dry white lead	$\frac{1}{2}$	ounce
Glycerine	3	ounces
Color to suit.		

Make a paste of zinc, chalk and glycerine by rubbing them up into a cream; then stir them into the liquid glue while hot and to about the consistency of syrup, and stir thoroughly; it is then ready for use in the white and can be colored any shade desired by using aniline to suit. Antique bronze color can be obtained first by adding a little dry bronze powder and then adding aniline of the shade desired. To be used warm over water bath, and can be used any number of times.

No. 2.

Rosin	40	pounds
Silicate of magnesia	25	pounds
Paraffine	2	pounds
Color to suit.		

Dissolve the rosin and paraffine with the aid of heat; stir in the silicate of magnesia, stirring until thoroughly incorporated; next add the color.

No. 3. Take ordinary hard paraffine and, when melted, stir in sufficient oil soluble and aniline to suit.

GRADUATING CONTAINERS.

Graduated containers will be found very convenient

when used as receivers in filtration or percolation operations, or for use in compounding. Plain containers may be graduated by placing them in a perfectly level position and carefully measuring out the exact quantity of water at 60 degrees F., next pasting a strip of bright-red-colored paper on the four quarter points, being careful to allow for the capillary curves; and, when dry, shellacking the surface of the paper.

DEODORIZING CONTAINERS.

Place in the container some mashed raw potatoes with warm water, and shake occasionally for one hour; then empty the contents and wash with cold water. The odor will then have entirely disappeared. Such obstinate odors as peppermint readily yield to this treatment. To clean containers from the dry, hard film frequently encountered, use a solution of potash with fine shot. This is also useful in removing fixed oils, etc.

ADHESIVES.

As a matter of convenience it is always desirable to employ an adhesive that can be used in the cold and, at the same time, that will dry in the shortest possible time. The best article for use on carton work is "silicate of soda"; it is inexpensive, does not ferment or decompose and will render very satisfactory results. Another good preparation is powdered corn starch digested with the aid of an alkali; however, considerable care is necessary in its preparation, since it is highly important that the minimum possible amount of alkali should be employed as per the following:

Into a suitable receptacle place one-half gallon of cold water; next stir in one pound of powdered corn starch and follow with one-half gallon of boiling-hot water into which has been added three fluid ounces of alkali solution; stir until the mass becomes clear and transparent and immediately reduce to the consistency desired with hot water. For carton work it should be used considerably heavier than for labeling. This paste will not ferment or decompose, and is very economical, but, as before stated, requires considerable care in its preparation.

ALKALI SOLUTION (FOR PASTE).

Dissolve Red Seal	1 can
Lye in water	1 quart

TABLES.

AVOIRDUPOIS WEIGHT.

Pounds.	Ounces.	Drachms.	Grains (Troy).	Grams.
1 =	16 =	256 =	7,000 =	453.60
	1 =	16 =	437.5 =	28.35
		1 =	27.34 =	1.77

FLUID MEASURE.

Gallons.	Pints.	Ounces.	Drams.	Minims.	Cubic Centimeters.
1 =	8 =	128 =	1,024 =	61,440 =	3,785.435
	1 =	16 =	128 =	7,680 =	473.179
		1 =	8 =	480 =	29.574
			1 =	60 =	3.697

Sixteen ounces, or one pint, is sometimes termed a fluid pound. The above table is the one usually adopted in formulas.

SYRUP TABLE.

Pounds of Sugar. Added to One Gallon of Cold Water.	Quantity of Syrup Actually Obtained.			Pounds of Sugar in One Gallon of Syrup.
	Gallons.	Pints.	Fluid Ounces.	
1	1	..	10	.93
2	1	1	4	1.73
3	1	1	14	2.43
4	1	2	3	3.05
5	1	3	2	3.6
6	1	3	12	4.09
7	1	4	6	4.52
8	1	5	..	4.92
9	1	5	10	5.28
10	1	6	4	5.62
11	1	6	14	5.92
12	1	7	8	6.18
13	2	..	2	6.38
14	2	..	12	6.7
15	2	1	6	6.91

AQUA (HOUSEHOLD) AMMONIA.

Ammonia is a colorless, pungent, suffocating gas (NH_3), and the commercial article is obtained from gas liquor. Water is capable of absorbing 670 times its volume of ammonia gas at 50 degrees F., increasing in bulk about two-thirds. Keep the tanks in a cool place and the plug secure, since heat rapidly expands the gas, with consequent loss and danger when drawing off. It is safer, if the ammonia has been kept in a warm room, to cool it off with ice water before attempting to withdraw the plug, as the liberated gas, when warm, frequently is forced out with extreme violence, and accidents which have resulted in injury to the sight of the operator are on record. The best antidote is the exposure or inhalation of vinegar or acetic acid.

Table Showing the Percentage of Gas contained at 60 Degrees Fahrenheit.

20 degrees Beaume.....	17	per cent.
19 " " 	15	" "
18 " " 	13.5	" "
17 " " 	12	" "
16 " " 	10	" "
15 " " 	8	" "
14 " " 	6.6	" "
13 " " 	5	" "
12 " " 	3.2	" "
11 " " 	1.6	" "

One gallon of 26 degrees weighs $7\frac{1}{2}$ pounds.

BOTTLES AND CORKS.

BOTTLES—CAPACITY, BREAKAGE, ETC.

The question of over-capacities and breakage of extract bottles is of sufficient importance in that it seriously affects the cost of production. It is a well-known fact that it is next to impossible to purchase bottles accurately graduated, since the workman or blower is compelled to guess at the quantity of glass he gathers for each bottle. He can do nothing else, as it is impossible to weigh or measure the molten mass. This is why it is impossible to guarantee the absolute accuracy of a bottle. However, some manufacturers are able to balance the variation to within about 2 per cent. either way, and this is about the best condition we can look to until the time when such a glass-blowing machine as the "Owens" will be adapted to the making of extract bottles.

Breakage of bottles is due to several causes: Improper combination of raw materials, an excess of silica, a deficiency of alkali, insufficient heat in furnace, uneven distribution, and improper annealing, since carelessness on the part of the lehr tender in not keeping his lehr at the correct temperature will cause breakage. A large amount of breakage is due to rough handling in transit by the transportation companies, draymen and receiving departments. The writer would suggest ordering bottles shipped in the open crate with paper packing, in place of the closed box with hay for packing, since in the former the men can see what they are handling and are more careful than they would be with the old-style package. The receiving department should be very careful before signing for bottle shipments to ascertain that the crates, cases and contents are in good condition. If not, they

should make a notation on the receipt that the goods were received "in damaged conditions, subject to claim."

Bottles should always be well washed prior to filling, irrespective of their clean appearance when taken from the packing case, for we must not forget that they are intended to contain a food product, and, since glass is a product resulting from a fusion at a high temperature of silica and alkali, very frequently traces of the alkali are found in the bottles, and these traces would have the tendency to deteriorate some of the more delicate flavors.

FILLING BOTTLES.

Bottle-filling machines are a valuable adjunct to concerns handling a large quantity of given size bottles at one time. In cases of frequent changing of containers and material, a cheap method consists of the use of a large, portable tray made of well-seasoned wood, of suitable length and depth to accommodate the tallest bottles. The tray should be lined with sheet copper, although zinc will answer the purpose, but will not last as long. It should be fitted with standards of four by four, and inclined to one of the corners, so that any liquid spilled by overflow or broken bottle can be quickly recovered through the drain. The standards should be fitted with roller-bearing castors of at least three inches diameter. This portable tray can be run to the bottle dryer and filled and next run to the source of supply and the bottles filled and corked with the aid of a rubber mallet. They can then be run to the labeling table and either labeled from the tray, or transferred to the tables, the latter being the better method, since all bottles ought to be permitted to lie flat on the table for a short time in order to ascertain that there are no leaky corks in the lot.

When filling bottles, the supply should be elevated on a superstructure at least forty inches higher than the portable tray. If the stock can be contained in a barrel, a suitable-sized rubber tube may be connected with the faucet; but in the event of the container being of glass, the syphon system will have to be employed, with the aid of a semi-circular rubber-tube supporter to obviate the kinking of the tube. A certain percentage of the bottles will be found to contain a surplus quantity, and these can rapidly be corrected with the aid of a wood displacement stick. This stick should be cut or dressed with a handle about $\frac{1}{2}$ inch diameter and $1\frac{1}{2}$ inches long; at this point a shoulder should be provided and the rest should be of a diameter sufficiently small to enter the bottle readily and of a length to displace the required amount; this will necessarily have to be determined by experiment.

CORKS.

Use a good three or 4 "X" extra long taper cork. Corks should be stored in a dry room, as, in a damp room, the corks attract moisture and, in consequence, molds attach themselves to them and they acquire not only an unpleasant, musty odor, but a bad taste, easily communicated to the contents of the bottles stoppered with them. Before using, immerse them in cold water, never hot water. Very frequently when removing a cork it will break, hence the advisability of placing in the carton an extra cork.

FIGURING COSTS.

The common error of computing costs of finished products wholly on formulas and costs of raw materials is practised by quite a number of concerns. Shrinkage losses, both visible and otherwise, are inevitable and must be carefully considered. For example, when equal quantities of water and alcohol are mixed, a curious phenomenon occurs, since they occupy less space than when separate, the shrinkage amounting to about $3\frac{3}{4}$ per cent. This shrinkage, being controlled entirely by nature, cannot, of course, be eliminated. There are other losses that develop in the manufacture of flavoring extracts, and the total content should be determined in each batch produced. This can be readily ascertained by the use of a card-recording system, as follows:

Extract Department.

Date, February 12, 1912.

Batch No. 1.

Character of stock produced, Tuxedo brand vanilla

Operation started, February 12.

Operation finished, February 20.

Total gallons required from formula, 22.

Per cent. of beans used, 10.

Character of beans used, Bourbon, 75 per cent.

Character of beans used, Mexican, 25 per cent.

Total amount of beans used, 17.6 pounds.

Cost of beans per pound, Bourbons, \$3.00.

Cost of beans per pound, Mexicans, \$3.50.

Per cent. of alcohol used in menstruum, 50.

Amount of finished product obtained, 21.25 gallons.

Amount of added menstruum required to complete,
.75 gallon.

Cost of same.....	\$1.00
-------------------	--------

Total cost of beans.....	55.00
--------------------------	-------

Amount and cost of alcohol used, 11 gallons

@ \$2.68	29.48
----------------	-------

Amount and cost of sugar used, 20 pounds

@ .05	1.00
-------------	------

Total labor required, 5 hours @ .40.....	2.00
--	------

Total cost for 22 gallons.....	\$88.48
--------------------------------	---------

Total cost per gallon.....	4.03
----------------------------	------

Remarks	
---------------	--

Extract Packing Department.

Date, March 5, 1912.

Character of stock packed, 2 oz. Tuxedo vanilla.

Amount of stock supplied, 14 gallons @

\$4.03\$56.42

Less 23/100 gallons remaining..... .93

Total cost of vanilla.....\$55.49

Bottles supplied, 6 gross @ \$2.15..... 12.90

Bottles broken, 18 27

Over-capacity, 2 per cent.=34.56 ounces.... 1.02

Six gross of cartons @ \$3.80 per 1,000..... 3.28

Corks and labels 1.60

Time required washing bottles, 1 girl, 2 40/60

hours, @ .10 27

Time required filling bottles, 1 girl, 3 20/60

hours, @ .11 37

Time required labeling and completing, 1 girl,

12 15/60 hours, @.11 1.35

\$76.55

Total cost per gross..... 12.76

To the above should be added a certain per cent. to cover supervision and general expenses.

The essential advantages of the recording system consist of providing ready means for determining the yearly output, including exact costs, of all grades of goods manufactured. It serves as a check on raw materials, including the shrinkage of alcohol, vanilla beans, etc., in original packages, and as an incentive to encourage employees to provide means for reducing leaks and waste to their lowest terms. It standardizes time requirements for various operations and provides means for determining the relative values of the employees. Again, since the capacities of stock bottles vary to an appreciable extent, this system will continually keep one in touch with the same.

Count, Weigh and Measure All Items on Receipt of Shipment.—As an illustration: On receipt of a barrel of 95 per cent. alcohol or 190 proof, if the barrel has on it the Government stamp, one is reasonably certain of its purity. Weigh the barrel at once and note if the weight agrees with the Government gauger's weight stamped near the bung; if it does not, notify the distiller or dealer at once. If the weight is correct, open the barrel, and with the aid of a hydrometer (alcoholometer) determine the proof. After the barrel is empty, weigh it and note if the tare as stamped on the barrel is correct, and if so, divide the net pounds by 6.7963, representing the weight of one gallon of 95 per cent. alcohol. The author would suggest that the alcohol be shipped in glue-coated barrels, as this prevents any solution from the wood of the barrel, which, in some instances, affects the color and solvent properties of the alcohol.

Index

- Acidity in Vinegar..... 65
 Adhesives 76
 African Vanilla Beans..... 14
 Age, Deteriorated Essential
 Oils 66
 Ageing Vanilla 24
 Alcohol...14, 27, 28, 29, 52,
 53, 61
 Alcoholic Content of Men-
 struums 29, 30
 Allspice (Pimento) Ext... 47
 Almond Extract 8, 42
 Almond Extract, Federal
 Standard 42
 Ammonia 64, 72
 Anise Extract 8, 47
 Apple Extract, Imitation.. 9
 Aqua-Ammonia 64, 72
 Avoirdupois Weight 71

 Bottle Breakage 73, 74
 Bottle Capacity 73
 Bottle Filling 74, 75
 Bottles 73-75
 Bottle Topping Wax For-
 mulas 68, 69
 Bourbon Vanilla Beans.... 11
 Brooks on Resins..... 15

 Care of Finished Extracts. 31
 Carton Adhesives 70
 Cassia Extract 8, 48
 Celery Extract 8, 47, 48
 Cherry Extract, Imitation. 9
 Chocolate Extract 49
 Cinnamon Extract 8, 48
 Circular No. 19, U. S.
 Dept. of Agriculture.... 8
 Classes of Extracts..... 8
 Clove Extract 49
 Cold Work in Extract
 Making 27
 Coloring, Use of..... 40
 Comoros, Vanilla Beans... 15
 Containers, Deodorizing... 69
 Containers, Graduating.... 69

 Corks 75, 76
 Cost Record, Extract De-
 partment 77
 Cost Record, Extract Pack-
 ing Department 78
 Costs of Extract Depart-
 ment 76, 77, 78, 79
 Coumarin 8, 25, 26, 28
 Coumarin Extract 8, 26
 Cultivation of Vanilla Beans 12
 Cutting Vanilla Beans..... 17

 Definition of Flavoring Ex-
 tract 8
 Deodorizing Containers.... 69
 Digestion in Vanilla Bean
 Exhaustion 20
 Diluting Alcohol, Rule for. 53
 Double Pressure Filter and
 Percolator 59, 60

 Essential Oil Extracts...8, 48
 Essential Oils.8, 32-36, 48, 61,
 62, 63, 64, 66
 Essential Oils Deteriorated
 by Age 66
 Esters Extracts, Estimati-
 ing Small Quantities of.. 8
 Ethereal, Imitation Fla-
 vors 50, 51
 Ethereal Extracts.....8, 9, 50
 Exhaustion of the Vanilla
 Bean 17
 Extract of Allspice (Pi-
 mento) 47
 Extract of Almond 8, 42
 Extract of Anise 47
 Extract of Cassia 48
 Extract of Celery 47, 48
 Extract of Chocolate 49
 Extract of Cinnamon 48
 Extract of Cloves 49
 Extract, Flavoring, What
 Constitutes a 8
 Extract of Ginger 44
 Extract of Lemon 32-36

- Extract of Mint (Spear-mint) 49
 Extract of Orange 8, 41
 Extract of Peppermint 43
 Extract of Pistachio, Imitation 59
 Extract of Rose 46
 Extract of Sarsaparilla ... 49
 Extract of Vanilla 10-25
 Extract of Wintergreen ... 43
 Extraction of Vanilla Beans 17
 Extracts by Maceration and Percolation 8
 Extracts from Essential Oils 8
 Extracts from Esters 8
 Extracts from Synthetics.. 8
 Extracts, Non-Alcoholic. 27, 28
 Federal Standard for Almond Extract 42
 Federal Standard for Extract of Anise..... 47
 Federal Standard for Cassia Extract 48
 Federal Standard for Celery Extract 47
 Federal Standard for Clove Extract 49
 Federal Standard for Cinnamon Extract 48
 Federal Standard for Ginger Extract 44
 Federal Standard for Lemon Extract 32
 Federal Standard of Oil of Lemon 32
 Federal Standard for Peppermint Extract 43
 Federal Standard for Rose Extract 46
 Federal Standard for Spearmint Extract 49
 Federal Standard for Tonka Extract 25
 Federal Standard for Terpeneless Lemon Extract. 34
 Federal Standard for Vanilla Extract 23
 Federal Standard for Wintergreen Extract 43
 Figuring Costs of Extract Department.... 76, 77, 78, 79
 Filling Bottles 74, 5
 Filter and Percolator, Double Pressure 59, 60
 Filtering Liquids 56, 57
 Filtering Papers 55, 56
 Filters 55-60
 Filtration 54-60
 Filtration Methods 54-60
 Finished Extracts, Care of. 31
 Flavoring Extract, What It Is 8
 Fluid Measure 71
 Formula for Allspice (Pimento) Extract 47
 Formula for Celery Ext.... 48
 Formula for Chocolate Extract 49
 Formula for Clove Ext.... 49
 Formula for Making Vanilla Extract 22, 23
 Formula for Peppermint Extract 44
 Formula for Almond Extract 42, 43
 Formula for Anise Extract 47
 Formulas for Cinnamon Extract 48
 Formulas for Ginger Extract 44, 45, 46
 Formula for Imitation Sarsaparilla Extract 49, 50
 Formulas for Lemon Flavor, Imitation 41
 Formulas for Imitation Pistachio Extract 50
 Formulas for Rose Extract 46, 47
 Formulas for Terpeneless Lemon Extract 38, 39
 Formulas for Wintergreen Extract 43
 Fruit Acid Solution..... 68
 Fruit Oils 51
 Gas in Aqua-Ammonia.... 64
 Ginger Extract.... 8, 44, 45, 46
 Graduating Containers.... 69
 Grinding Vanilla Beans.... 17
 Guadeloupe Vanilla Beans. 11
 Harrop on Flavoring Ext. 24
 Hot Work in Extract Making 27

- Household Ammonia 72
Howard Method for Essential Oils 64
Imitation Extracts 8, 9, 26
Imitation Lemon Flavor... 40
Imitation Pistachio Ext.... 50
Imitation Sarsaparilla Ext. 49
Imitation Vanilla Extract.. 26
Java Vanilla Beans..... 12
Labeling Imitation Ext.... 28
Laboratory Notes 52-56
Lemon Extract 8, 32-36
Lemon Ext., Fed. Standard 32
Lemon Extract, Mfg.... 32-36
Lemon Flavor, Imitation... 40
Lemon Flavor, Imitation, Formulas 41
Lemon Oil 32, 33
Maceration in Vanilla Bean Exhaustion 19
Machines for Cutting Vanilla Beans 17
Machine for Mechanical Maceration of Vanilla Beans 20, 21
Manufacture of Lemon Extract 32-36
Manufacture of Terpeneless Extract of Lemon. 34-39
Manufacture of Vanilla Extract 10-25
Manufacture of Various Extracts 42-49
Mauritius Vanilla Beans... 11
Meat Cutters for Vanilla Beans 17
Mechan. Maceration Process for Vanilla Beans... 22
Menstruums for Vanilla Bean Exhaustion..... 18
Methods for Testing Oils, 61, 62, 63
Mexican Vanilla Beans.... 11
Mint Extract 49
Miscellaneous Extracts... 42-49
Miscellaneous Recipes... 67-69
Non-Alcoholic Extracts. 27, 28
Nutmeg Extract 8
Oil of Lemon..... 32, 33
Oil of Lemon, Federal Standard of 32
Oil of Orange..... 32
Oil Testing 61, 62, 63
Orange Extract 8, 41
Orange Oil 33
Peach Extract, Imitation.. 9
Peppermint Extract 8, 43
Percolating Process in Vanilla Bean Exhaustion. 20, 22
Percolation in Vanilla Bean Exhaustion 18, 19
Percolators for Testing Vanilla Beans 16
Pimento (Allspice) Ext... 47
Pineapple Ext., Imitation.. 9
Pistachio Ext., Imitation... 50
Plain or Simple Syrup.... 67
Proof Spirit 52
Purchasing Vanilla Beans. 16
Purifying Essential Oils... 66
Qualifications of a Manufacturer 7
Qualitative Tests for Water 54
Raspberry Ext., Imitation. 9
Record of Costs, Extract Department 77, 78
Remington on Maceration. 19
Remington on Percolation. 19
Resins 14
Rose Extract..... 1, 8, 46, 47
Rule for Diluting Alcohol. 53
Sarsaparilla Extract 49
Sassafras Ext., Imitation.. 9
Sealing Wax Formulas.. 68, 69
Selecting Vanilla Beans... 15
Seychelles Vanilla Beans... 11
Soda Foam, Formula..... 67
Solution, Fruit Acid..... 68
Spearmint Extract 49
Standard, Federal, Extract of Almond 42
Standard, Federal, for Anise Extract 47
Standard, Federal, for Cassia Extract 48
Standard, Federal, for Celery Extract 47

- Standard, Federal, for Cin-
 namon Extract 48
 Standard, Federal, for Clove
 Extract 49
 Standard, Federal, for Gin-
 ger Extract 44
 Standard, Federal, for
 Lemon Extract 32
 Standard, Federal, Oil of
 Lemon 32
 Standard, Federal, for Pep-
 permint Extract 43
 Standard, Federal, for Rose
 Extract 46
 Standard, Federal, for
 Spearmint Extract 49
 Standard, Federal, for Ter-
 peneless Lemon Extract. 34
 Standard, Federal, for
 Tonka Extract 25
 Standard, Federal, for Va-
 nilla Extract 23
 Standard, Federal, for
 Wintergreen Extract.... 43
 Storing of Vanilla Beans 16
 Strawberry Extract, Imita-
 tion of 9
 Synthetical Extracts 8
 Syrup Formula 67
 Syrup Table 71
 Tables of Weights and
 Measures 71
 Tahiti Vanilla Beans..... 12
 Terpeneless Extract of
 Lemon 8, 34-39
 Terpeneless Lemon Ext.,
 Federal Standard 34
 Terpeneless Lemon Ext.,
 Formulas 38, 39
 Terpeneless Orange Ext... 8
 Test Percolators for Va-
 nilla Beans 16
 Testing Oil of Lemon 62
 Testing Oil of Cloves 62
 Testing Oil of Almond ... 62
 Testing Methods 61, 62, 63
 Testing Otto of Roses..... 63
 Testing Vanilla Extract... 31
 Tests for Water, Rules.... 54
 Thyme Extract 8
 Tonka Extract 8, 25
 Tonka Extract, Federal
 Standard 25
 U. S. Definition of Flavor-
 ing Extracts 8
 Use of Coloring..... 40
 Vanilla Beans 10, 11, 15
 Vanilla Bean Exhaustion.. 17
 Vanilla Bean Storage..... 16
 Vanilla Beans, Varieties
 10, 11, 12, 13
 Vanilla Beans, Where Cul-
 tivated 10
 Vanilla Extract 8, 10, 25
 Vanilla Extract, Federal
 Standard 23
 Vanilla Ext., Formula.. 22, 23
 Vanilla Extract, Manufac-
 ture 10-25
 Vanilla Extract, Testing... 31
 Vanilla Resins 15
 Vanillin... 8, 13, 14, 25, 26, 28
 Vanilla Extract 8, 26
 Varieties of Vanilla Beans 10
 Various Extracts 42-49
 Vinegar 65
 Water Tests 54
 Weights and Measures,
 Tables 71
 What Constitutes a Flavor-
 ing Extract 8
 White Vanilla 27
 Wintergreen Extract.... 8, 43

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